BS EN 16348:2013

BSI Standards Publication

Gas infrastructure — Safety Management System (SMS) for gas transmission infrastructure and Pipeline Integrity Management System (PIMS) for gas transmission pipelines — Functional requirements

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 16348:2013.

The UK participation in its preparation was entrusted to Technical Committee GSE/33, Gas supply.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 76682 4

ICS 23.040.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16348

June 2013

ICS 23.040.01

Supersedes CEN/TS 15173:2006, CEN/TS 15174:2006

English Version

Gas infrastructure - Safety Management System (SMS) for gas transmission infrastructure and Pipeline Integrity Management System (PIMS) for gas transmission pipelines - Functional requirements

Infrastructures gazières - Système de management de la sécurité (SMS) pour infrastructures de transport de gaz et système de management de l'intégrité des canalisations (PIMS) pour canalisations de transport de gaz - Exigences fonctionnelles

Gasinfrastruktur - Sicherheitsmanagementsystem (SMS) für die Gastransportinfrastruktur und Rohrleitungsintegritätsmanagementsystem (PIMS) für Gastransportleitungen - Funktionale Anforderungen

This European Standard was approved by CEN on 8 May 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16348:2013: E

Contents

Page

Foreword

This document (EN 16348:2013) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2013, and conflicting national standards shall be withdrawn at the latest by December 2013.

This document supersedes CEN/TS 15173:2006 and CEN/TS 15174:2006.

This European standard has been drafted by merging the contents of the CEN/TS 15173 “Gas supply systems – Frame of reference regarding pipeline integrity management system (PIMS)” and CEN/TS 15174 “Gas supply systems – Guidelines for safety management systems for natural gas transmission pipelines”. It aims to be a frame of reference for a transmission system operator (TSO) to develop and maintain a management system for ensuring a safe and reliable gas transmission infrastructure.

This standard presents all the activities to be carried out to implement a safety management system (SMS) covering the complete TSO's infrastructure. A section is specifically dedicated to the integrity management of transmission pipelines.

This standard is based on the state of the art management and maintenance practices of TSOs as these have proved historically to maintain high levels of safety, including improvements.

The structure adopted by this standard follows the structure implemented by the standard EN ISO 14001. This standard requires the TSO to develop and implement a management system for the safety and the reliability of a gas transmission infrastructure with the same basic principle: plan, do, check and act (PDCA).

Two main goals have been identified to achieve this principle. These are to have:

— a management system specific for the gas transmission infrastructure activity, but aligned with the most recognised standards for management systems;

— the possibility to integrate the SMS with other systems used in the organisation where they already exist.

All assets within a gas transmission system require an integrity management system to ensure the safe and reliable operation of the infrastructure. The section on Pipeline Integrity Management System (PIMS) within this document (Clause 5) addresses specific issues related to maintaining the integrity of the gas transmission pipelines. The reason for having a PIMS is to manage the safety aspects associated with operating underground transmission pipelines, which can be located in an open environment where the public can access the pipeline route.

This standard describes the resources, information systems and technical and organisational activities, for which the TSO is responsible and which are needed to prevent incidents and mitigate their consequences.

These resources and activities are implemented according to the technical and economic requirements specific to each TSO.

Through this SMS, the TSO and its stakeholders are ensured of a safe gas transmission infrastructure. The SMS enables the transmission system operator to comply with its policy and

objectives to manage safety aspects. The policy and the objectives take into account legal requirements and other requirements to which TSO subscribes.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies requirements which enable a Transmission System Operator (TSO) to develop and implement a safety management system including an integrity management system specifically for pipelines.

The SMS is applicable to infrastructure for the transmission of processed, non-toxic and non-corrosive natural gas according to EN ISO 13686 and injected bio methane, where:

— the pipeline elements are made of unalloyed or low-alloyed carbon steel;

— the pipeline elements are joined by welds, flanges or mechanical joints.

NOTE 1 In this standard, the term “natural gas” includes injected bio methane or other non-conventional forms of natural gas, e.g. shale gas.

Gas infrastructures for the transmission of natural gas covered by this standard are:

— pipelines onshore including valve stations;

— compressor stations;

— measuring and pressure reduction stations.

Gas distribution assets as well as LNG plants, terminals, underground storages are excluded from the scope of this standard.

Occupational health and safety is excluded from this European standard because it is covered by national legislation and other European and/or international standards, e.g. OHSAS 18001.

This European standard specifies requirements on a general level. The referenced documents given in Clause 2 “Normative references” give more detailed requirements for some of the assets listed above.

This European Standard is intended to be applied in association with these national standards and/or codes of practice setting out the above-mentioned basic principles.

In the event of conflicts in terms of more restrictive requirements in national legislation/regulation with the requirements of this standard, the national legislation/regulation takes precedence as illustrated in CEN/TR 13737 (all parts).

NOTE 2 CEN/TR 13737 (all parts) contains:

— clarification of relevant legislation/regulations applicable in a country;

— if appropriate, more restrictive national requirements;

— national contact point for the latest information.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1594, *Gas supply systems - Pipelines for maximum operating pressure over 16 bar - Functional requirements*

EN ISO 13686, *Natural gas - Quality designation (ISO 13686)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
transmission system operator
TSO
natural or legal person who carries out the function of transmission and is responsible for operating, ensuring the maintenance of, and, if necessary, developing the transmission system in a given area and, where applicable, its interconnections with other systems, and for ensuring the long-term ability of the system to meet reasonable demands for the transport of gas

Note 1 to entry This definition is identical with that given in the EU Directive on the common gas market 2009/73/EU.

3.2
inspection
the process of measuring, examining, testing, gauging or otherwise determining the status of items of the pipeline system or installation and comparing it with the applicable requirements

Note 1 to entry This definition is identical with that given in EN 1594.

3.3
maintenance
combination of all technical and associated administrative actions intended to keep an item in, or restore it to, a state in which it can perform its required function

Note 1 to entry This definition is identical with that given in EN 1594.

3.4
operation
activities to control the gas flow through operation of compressors, regulators, valves, etc. under the conditions that gas pressure, gas quality and gas temperature (safety) limits set by the operator and/or standards are not exceeded

3.5
safety
the condition of the gas infrastructure being acceptable for the population, for the environment and for the continuity of supply ensured by the adoption of adequate measures in the design, construction, operation and maintenance of the gas infrastructure

Note 1 to entry The definition of the level of acceptability is in the responsibility of the stakeholders of a specific gas transmission system e.g. authorities, TSO.

3.6
safety aspect
element or event that, if not properly managed, can cause a potential hazard for the population, the environment and for the gas infrastructure

3.7
safety management system
SMS
set of appropriate activities and practices by which a transmission system operator preserves a safe and reliable gas transmission system and mitigates the consequences of incidents

Note 1 to entry The pipeline integrity management (PIMS) is an integral part of the safety management system.

3.8
pipeline integrity
condition of the gas transmission pipeline to ensure safe and reliable transportation of natural gas

3.9
pipeline integrity management system
PIMS
set of appropriate activities and practices by which a transmission system operator preserves the integrity of the gas transmission pipeline to ensure safe and reliable transportation of natural gas

4 Safety management system (SMS)

4.1 General requirements

The SMS shall ensure:

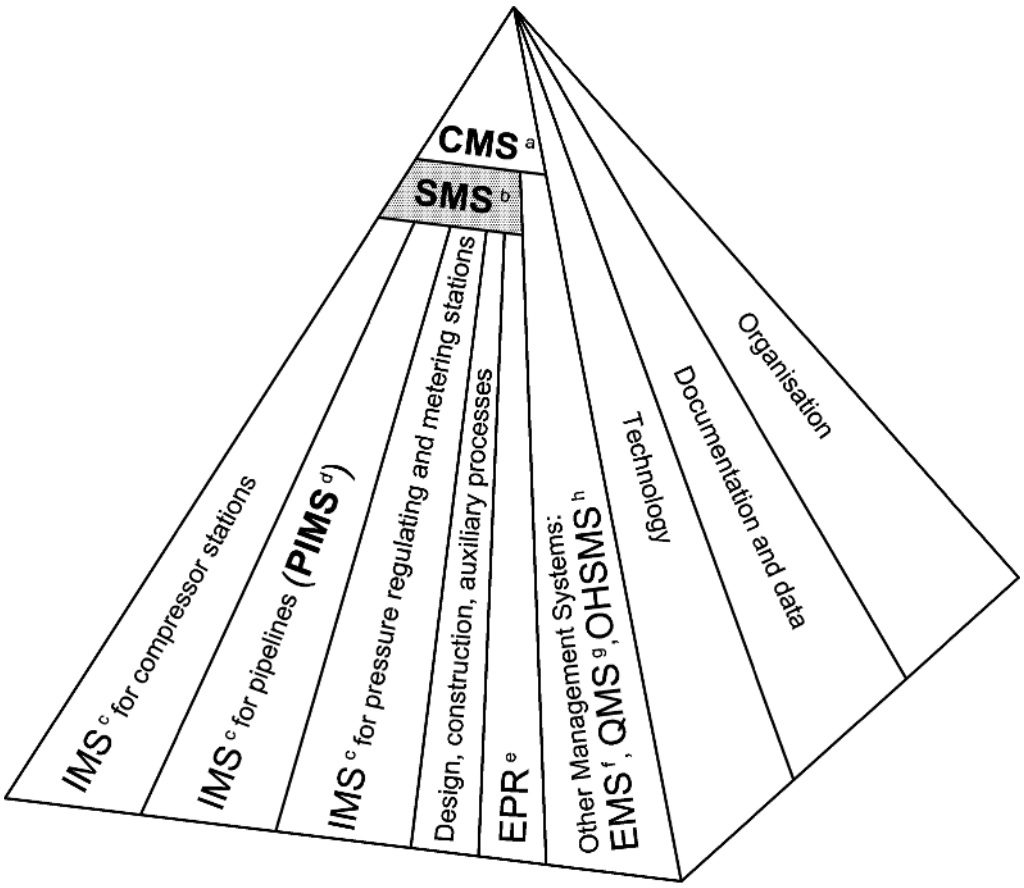
— the safety of the public;

— the protection of urban, natural or industrial environment;

— the service life and reliability of natural gas infrastructure.

The safety management system is an essential part of the company management system see Figure 1. The SMS described in this standard is designed in accordance with the structure and the general principles of EN ISO 14001 and OHSAS 18001.

The alignment of the SMS structure with the structure of EN ISO 14001 and OHSAS 18001 helps the integration with other management systems adopted by the TSO such as for quality, environment, occupational health and safety.



Key

a – CMS - Company Management System

b – SMS - Safety Management System (for gas transmission infrastructure)

c – IMS - Integrity Management System

d – PIMS - Pipeline Integrity Management System (see Clause 5)

e – EPR - Emergency Preparedness and Response Procedure (see 4.4.7)

f – EMS - Environment Management System

g – QMS - Quality Management System

h – OHSMS - Occupational Health and Safety Management System

Figure 1 — Example of architecture of a company management system of a TSO

The TSO shall establish, implement and maintain a safety management system for the gas infrastructure, by fulfilling the requirements specified in Clause 4.

The structure of the SMS shall follow the Deming cycle based on the principle of plan, do, check, act (PDCA). PDCA shall be applied to each of the life cycle stages of the gas transmission infrastructure:

— design;

— construction and commissioning;

— operation (including emergency management);

— maintenance;

— permanently taken out of service.

The SMS shall consider and respond to the safety aspects of:

a) the main processes which are the stages of the life cycle of a gas transmission infrastructure mentioned above. This enables the TSO to perform its primary tasks to achieve the required safety and reliability of the gas transmission infrastructure;

b) the auxiliary processes which support the main processes in a proper and effective way and which comprises the following:

    1) training;

    2) purchasing;

    3) communication;

    4) documentation;

    5) monitoring developments in regulation and innovation.

NOTE The processes above are in accordance with TSO practice.

The SMS shall address the fundamental requirements for the safety and reliability of a gas transmission infrastructure to maintain the integrity of buried pipelines and pipelines outside fenced-off areas, as these areas are generally accessible by third party and public. For this purpose a pipeline integrity management system is described in detail in Clause 5 of this standard.

4.2 Management commitment and safety policy

The TSO top management shall provide visible and active leadership in developing and maintaining a culture that supports the management of safety.

The top management shall define a safety policy in which overall objectives and a commitment to maintain or improve safety performance are clearly stated.

The safety policy shall:

a) be appropriate to the nature, scale and safety impacts of its activities;

b) include commitments to:

    1) the prevention of incidents;

    2) ensure safe and reliable transportation of natural gas;

    3) the mitigation of consequences for the public, the environment and the transmission of gas;

c) include a commitment to comply with relevant legislation and regulations, and with company requirements and commitments;

d) provide the framework for setting and reviewing safety objectives and targets;

e) be documented, implemented and maintained and communicated to all employees;

f) be made available to stakeholders.

4.3 Planning

4.3.1 Safety aspects

The TSO shall have a procedure to identify and list the safety aspects. The TSO shall document the safety aspects and keep them under review.

The TSO shall describe how these aspects are managed by the SMS through appropriate controls.

The safety aspects are usually similar for large parts of the infrastructure. In some cases, there are local safety aspects, which shall also be considered.

The TSO shall define the procedures, services and equipment that are safety critical for the management of the safety aspects.

4.3.2 Legal and other requirements

The TSO shall have a procedure to identify legal requirements and other requirements to which the TSO subscribes, that are applicable to the safety aspects of its activities.

The TSO shall ensure that these requirements are taken into account when establishing, implementing and maintaining its SMS.

4.3.3 Objectives, targets and programme

The TSO shall have documented safety objectives and targets that take into account the legal and other requirements, technological developments, operational and business requirements. These objectives and targets shall be consistent with the safety policy (see 4.2).

The targets shall be measurable.

The TSO shall have a programme for achieving its objectives and targets. The programme shall include as a minimum:

— designation of responsibility and authority for achieving objectives;

— the means and the time-frame by which the objectives are to be achieved.

The programme shall be reviewed on a regular basis and at planned intervals and adjusted when necessary.

4.4 Implementation and operation of the SMS

4.4.1 Structure, responsibility and resources

The TSO top management shall appoint specific management representatives who, irrespective of other responsibilities, shall have defined roles, responsibilities and authority for:

— ensuring that the safety management system is established, implemented and maintained in accordance with this standard;

— reporting on the performance of the safety management system to top management for review and as a basis for improvement of the safety management system.

Top management shall provide resources required for the implementation and control of the safety management system. Resources include human resources with appropriate skills, technology and financial resources.

The TSO shall define and document the organisation and responsibilities for:

a) ensuring compliance with the safety policy;

b) the identification, recording and follow-up of corrective or improvement actions;

c) the control of abnormal situations including emergencies;

d) the identification of training needs, their provision and the evaluation of their effectiveness;

e) auditing the SMS.

4.4.2 Awareness, training, and competence

The TSO shall ensure that its employees are aware of:

— the importance of conformance to the safety policy, to the safety aspects and to the requirements of the SMS;

— their roles and responsibilities in achieving conformance to the safety policy, the procedures and the requirements of the SMS;

— the renewal of training and education when necessary.

The TSO shall ensure that its employees, performing tasks that can affect any safety aspects, are competent on the basis of appropriate education, training or experience.

The TSO shall check that its employees undertake the appropriate training and updates of training and shall retain associated records

Contractors performing tasks for the TSO or on its behalf, that can affect any safety aspects, shall demonstrate their competence and shall retain associated records.

Informative meetings that are relevant for the SMS shall be documented.

4.4.3 Communication of the SMS

The TSO shall have a procedure and tools for:

— internal communication about all details of the SMS between the various levels and functions of the organisation;

— external communication about the relevant aspects of the SMS with stakeholders during the whole life cycle of the gas infrastructure.

4.4.4 Documentation of the SMS

The TSO shall have documented information, in paper or electronic form, to describe the core elements of the safety management system.

The core elements are:

a) the safety policy;

b) description of the scope of the SMS;

c) description of the safety aspects;

d) procedures for the main processes of the system and reference to the related documents;

e) documents necessary to ensure the effective planning, operation and control of processes that relate to the safety aspects.

The TSO can decide to define and adopt internal company standards based on legal requirements, national standards, European and/or international standards, adapted to its own skills and knowledge.

4.4.5 Control of Documents

The TSO shall have a procedure for controlling all documents required by this European Standard to ensure that:

a) the current versions of relevant documents are available at all locations where operations of the gas transmission infrastructure required for the effective functioning of the safety management system are performed;

b) they are revised when necessary and approved for adequacy by authorised personnel prior to issue;

c) obsolete documents are removed from the system;

d) any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified;

e) documentation is legible, clear, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period;

f) procedures and responsibilities are established and maintained concerning the creation and modification of the various types of documents.

4.4.6 Operational control of the SMS

4.4.6.1 General

The safety aspects shall be managed by operational control, aiming at the prevention of incidents.

The TSO shall have a procedure that defines the resources and activities to carry out the operational control of the main processes, i.e. design, construction and commissioning, operation and maintenance.

The above processes together with the emergency preparedness and response (see 4.4.7), constitute the core of the SMS enabling the TSO to perform its primary tasks for the safety and the reliability of gas transportation.

4.4.6.2 Design of the gas transmission infrastructure

The design process is the first and essential step that enables the TSO to ensure a safe and continuous supply of natural gas through the gas transmission infrastructure.

The TSO shall have a procedure for the management and the control of the design of new infrastructures and of modifications of the existing ones, assuring that the following requirements are met:

— the safety policy;

— the safety objectives and targets;

— legal requirements.

The procedure related to the design activity for stations, pipelines or their modification shall take into consideration the following items:

a) application of technical standards: reference shall be made to the relevant European, national, international and/or internal TSO standards;

b) selection of (a) designer(s): the design shall be carried out by qualified designer(s) who can be either internal or external;

c) identification of the relevant safety aspects for the specific project and definition of the measures to manage them;

d) design supervision: the extent and detail of the design shall be sufficient to demonstrate that the integrity and availability can be maintained during the design life of the infrastructure;

e) design review: the design shall be reviewed and approved by the TSO or by independent bodies;

f) documentation: a complete set of documents shall be maintained containing a description of the infrastructure, drawings, data of components and structures and, if required, other construction information. A handover document which lists the documents necessary for the commissioning of the infrastructure shall be defined.

The TSO may define exemptions in cases where a deviation to the above list of items is needed.

4.4.6.3 Construction and commissioning of the gas transmission infrastructure

The construction and commissioning shall be undertaken in compliance with the legislation in force in the country in which the infrastructure is built and shall follow the recognised codes and standards governing civil works, welding, mechanical works, electrical works and testing.

If the construction is to be carried out by external contractors, then the TSO shall ensure that competent contractors are selected. Contractors appointed by the TSO shall possess the qualifications necessary for executing the work.

The TSO shall establish procedures to select the appropriate construction and commissioning methods, tools and equipment in order to ensure that design requirements are met after commissioning.

The construction and commissioning shall be carried out taking care of the specific safety aspects defined during the design phase. If during the construction phase design specifications cannot be met, the design shall be reviewed to reconsider the safety aspects before construction continues.

The safety of the public shall be ensured during the whole period of the works.

The TSO shall have safety procedures for carrying out construction and commissioning activities that can affect existing gas infrastructure, maintenance or operational activities.

The TSO shall maintain a complete set of documents containing as-built drawings, component data and relevant construction information.

The TSO shall have a procedure for the operational handover after commissioning.

4.4.6.4 Operation of the gas transmission infrastructure

The main objective of operation is to ensure that the gas is safely and reliably transported according to contractual agreements.

The TSO shall ensure that gas entering its infrastructure meets requirements for preservation of the network's integrity.

In order to fulfil this objective the TSO shall have a system to continuously monitor and control pressure, flow, temperature and gas quality at key points throughout the network in real time.

This system shall be managed by competent personnel who are present 24 h per day. They shall be provided with systems that are able to receive information about anomalies and incidents coming from:

— pressure and flow measuring devices;

— the local operating units;

— the public;

— the authorities.

The TSO shall have adequate procedures to deal with operational, maintenance and commissioning activities and emergencies at all times, ensuring that public safety and the balance of the network are maintained as far as reasonably practical.

NOTE This sub-clause is relevant for Clause 5 PIMS for managing the integrity of transmission pipelines during their operational life.

4.4.6.5 Maintenance of the gas transmission infrastructure

The objective of maintenance is to ensure that the gas infrastructure is kept safe and reliable for service during its operational life.

For this objective the TSO shall have a maintenance function in place. The maintenance can be carried out by internal personnel or can be outsourced. Either way, personnel shall be competent with reference to 4.4.2.

The TSO shall have maintenance procedures depending on the safety aspects and the type of the gas infrastructure (pipelines, compressor stations, etc.). The maintenance activities shall also compensate for design and/or construction deficiencies identified during the operational phase of the infrastructure.

The TSO shall ensure that tools and equipment are fit for purpose and that instruments are calibrated. The maintenance results shall be recorded and regularly analysed by the TSO for

identifying trends that can require improvements to the maintenance processes or to the infrastructure.

NOTE This sub-clause is relevant for Clause 5 PIMS for managing the integrity of transmission pipelines during their operational life.

4.4.6.6 Gas infrastructure permanently out of service

When gas infrastructure is taken permanently out of service (abandonment) the objective is to ensure that the gas infrastructure is left in a safe state. Therefore, the TSO shall have procedures to either remove abandoned infrastructure or to deal with any safety aspects that might still remain during the existence of the abandoned infrastructure.

NOTE 4.4.6.6 is relevant for PIMS (Clause 5) for managing the integrity of transmission pipelines during their operational life.

4.4.7 Management of emergency situations

The TSO shall have an emergency preparedness and response procedure (EPR) to respond to emergencies or anomalous situations and to prevent or mitigate safety impacts.

The TSO shall analyse emergency situations and anomalous situations and when necessary review and revise its EPR procedures. The TSO shall periodically review its capability of emergency preparedness and response.

The EPR shall define:

a) the system for receiving notifications of emergencies or anomalous situations which shall be available 24 h per day;

b) the roles and responsibilities for emergency response;

c) the resources and documentation necessary to respond to emergencies;

d) the liaisons with local authorities and emergency services;

e) the interface with the TSO communication plan for emergency situations.

For emergency preparedness and response with respect to pipelines reference shall be made to EN 1594.

4.4.8 Purchasing of equipment or services

4.4.8.1 General

For the purchasing of equipment or services which can have an impact on the safety aspects of the main processes the TSO shall establish a policy:

— to select and purchase safe and reliable products and services;

— to comply with regulations, internal procedures and European, or national and/or international standards when no European standards exist.

4.4.8.2 Implementation and operation of purchasing procedures

The TSO shall have a purchasing procedure for the services and equipment that are safety critical. This procedure shall contain the following:

a) specification phase: In general, each purchase shall be appropriately specified;

b) preliminary selection phase: In this phase qualification of the suppliers or services providers and/or technical qualification tests shall take place;

c) purchasing and manufacturing phase: In this phase inspections of manufacturing operations and periodic audits, contract performance, in the case of service providers, and the establishing of the acceptance procedure shall take place.

In specific cases, it is possible to simplify the procedure provided the safety policy of the TSO is respected.

4.4.8.3 Control of purchasing – process review

In order to improve the purchasing of equipment and services, status reviews shall be carried out concerning:

— the re-qualification of suppliers and service providers and technical re-qualification tests;

— the implementation of technical and organisational improvements by suppliers and service providers;

— the performance of contracts (quality and lead times);

— the evaluation of the purchasing process leading to an improved purchasing procedure.

4.4.9 Innovation

The TSO shall monitor technology developments in gas transmission infrastructure in order to evaluate the opportunity to introduce improvements in the processes or in equipment. This monitoring can be achieved by literature review, by information exchange through the participation in industry groups and associations, through the participation at applicable conferences and by benchmarking with other TSOs.

The TSO shall evaluate the safety impact of new technologies before they are implemented.

4.5 Checking and corrective action of the SMS

4.5.1 Monitoring and measurement

The TSO shall have a procedure to monitor and measure, on a regular basis, the performance of the SMS by utilising these indicators. For this, the TSO shall define key performance indicators of its SMS.

Key performance indicators of the SMS can include:

— the number of incidents;

— the consequences or severity of the incident;

— the operation and maintenance parameters;

EXAMPLE 1 pressure monitoring, surveillance, inspections

— other elements of the safety management system.

EXAMPLE 2 training, fulfilment of the objectives and targets, progress of programmes according to 4.3.3, audits.

The adoption of indicators for European benchmarking on gas infrastructure safety shall be considered by the TSO.

4.5.2 Evaluation of compliance

Consistent with its commitment to compliance, the TSO shall have a procedure for evaluating compliance with applicable legal requirements and with other requirements to which it subscribes concerning the safety aspects of the SMS.

The TSO shall keep records of the results of the evaluations.

4.5.3 Nonconformity, corrective action and preventive action

The TSO shall have a procedure for dealing with SMS nonconformities and for taking corrective and preventive action.

SMS nonconformities can be revealed by:

— internal audit (see 4.5.3);

— management review (see 4.6);

— communication/request by authorities;

— internal communication;

— incident review.

The procedure shall cover:

a) identifying and correcting nonconformities and taking action(s) to mitigate their safety impacts;

b) investigating nonconformities, determining their cause(s) and taking actions in order to avoid their reoccurrence;

c) recording the results of corrective and preventative action(s) taken;

d) reviewing the effectiveness of corrective and preventative action(s) taken;

e) the verification that the implementation of the corrective action will not lead to other nonconformities.

4.5.4 Control of records

The TSO shall establish and maintain records as necessary to demonstrate conformity to the requirements of its SMS.

Records shall be legible, identifiable and traceable.

4.5.5 Internal audit

Internal audits shall be conducted to assess the effectiveness of the SMS and to identify findings. The TSO shall have a procedure for internal auditing. This shall include the definition of an audit programme and the conduct of audits. The programme shall be based on the safety impact of the activity concerned and the findings of previous audits.

The audit shall:

a) determine if the SMS has been properly implemented and maintained;

b) determine the effectiveness of the SMS in meeting the TSOs policy and objectives;

c) review the results of previous audits.

The results of the audits shall be provided to the management.

Selection of auditors and conduct of audits shall ensure objectivity and the impartiality of the audit process.

4.6 Management review

The TSO's top management shall review the performance of the safety management system at specified intervals in order to ensure that the SMS is suitable and effective. The management review process shall ensure that the necessary information is collected in order to allow top management to carry out this evaluation.

The management review shall be documented and the documents retained.

Management reviews shall include:

a) the performance of the SMS in terms of key performance indicators;

b) the results of internal audits and evaluations of compliance with SMS requirements;

c) the communication(s) from external interested parties, including complaints;

d) the status of corrective and preventive actions to mitigate and avoid nonconformities;

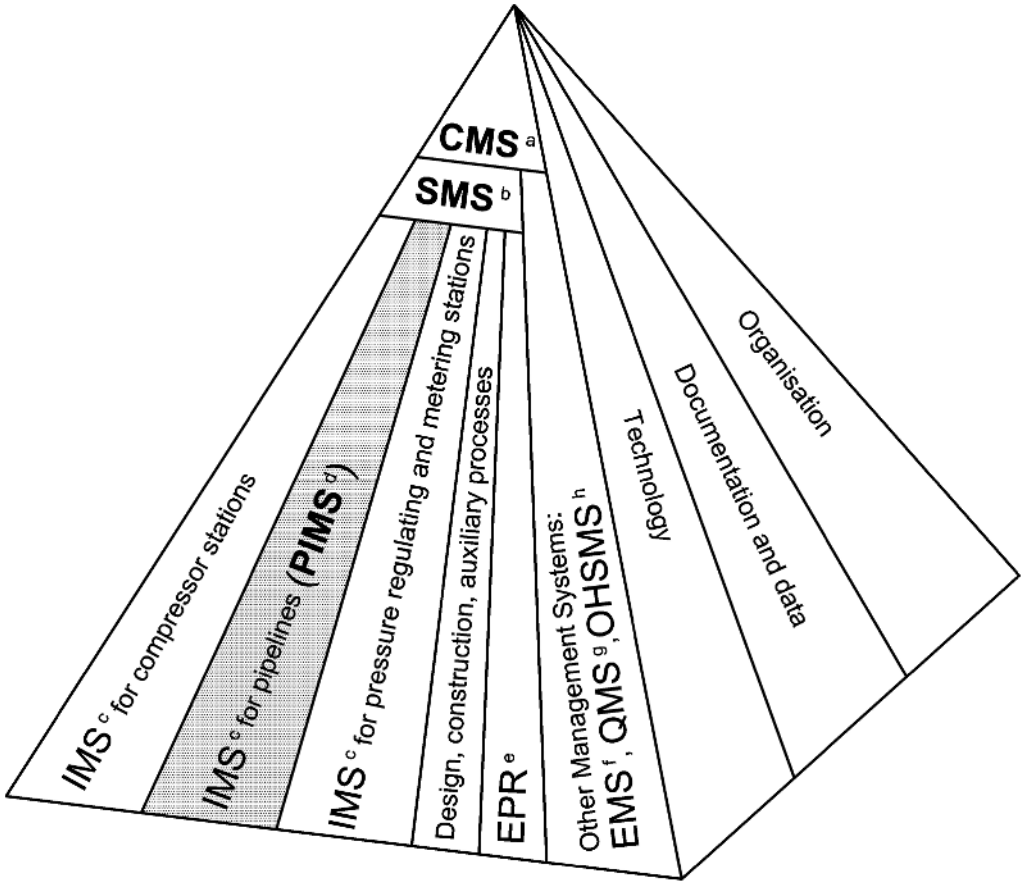
e) the status of follow-up actions from previous management reviews;

f) changing circumstances, including developments in legal and other requirements relating to safety aspects;

g) the definition of new programme(s) for improvement including responsibilities, time schedule and provision of resources.

5 Pipeline Integrity Management System (PIMS)

5.1 General requirements



Key

a – CMS - Company Management System

b – SMS - Safety Management System (for gas transmission infrastructure

c – IMS - Integrity Management System

d – PIMS - Pipeline Integrity Management System

e – EPR – Emergency Preparedness and Response Procedure

f – EMS - Environment Management System

g – QMS - Quality Management System

h – OHSMS - Occupational Health and Safety Management System

Figure 2 — Position of PIMS within the company management system

The TSO shall have a PIMS as a part of the SMS. For this reason, when implementing the PIMS the TSO shall consider all other elements in Clause 4 complementary to the specific elements defined in this clause.

PIMS starts after the commissioning of a transmission pipeline.

The first objective of the PIMS is to preserve the integrity of the pipelines through the management of the relevant safety aspects. By this PIMS contributes to the safety and availability of the gas transmission pipelines. In particular, the PIMS shall take into account the fact that

transmission pipelines can be located in an open environment where the public can access the pipeline route.

The second objective of the PIMS is to demonstrate the integrity of the pipelines during their operational life to stakeholders.

The TSO shall take into account safety aspects from preceding SMS stages like design, purchasing and construction (see EN 1594) when developing its PIMS since these define the pipeline's safety level at the start of its operational life. The PIMS shall include feedback loops to these SMS processes to take into account integrity issues found during the pipeline's lifetime, which could lead to an improvement of these processes for new pipelines. The operational control activities as required by PIMS are described in 4.4.6.4, 4.4.6.5 and 4.4.6.6.

The TSO shall conduct the following activities as part of the systematic approach of the PIMS:

a) identification of the safety aspects for pipeline integrity (5.2);

b) preparation of PIMS programmes (5.3);

c) application of integrity programmes (5.4);

d) assessment of integrity (5.5);

e) mitigation (5.6).

This systematic approach includes:

— gathering data and information on the relevant safety aspects to allow TSOs to prioritise and plan maintenance activities;

— determining which inspection, prevention and/or mitigation activities will be performed and when;

— learning from incident experience and adapting the policy towards integrity preservation accordingly;

— documentation of the relevant data.

5.2 Identification of the safety aspects for pipeline integrity

The TSO shall identify, define and document the safety aspects that can affect the integrity of the pipelines as defined in 4.3.1.

The main safety aspects that can affect integrity according to European experience can be categorised as follows:

— external interference;

EXAMPLE 1 third party damage

— ground movement;

EXAMPLE 2 landslide, erosion, flood, mining subsidence, mud flows

— corrosion;

EXAMPLE 3 external, internal alternating current, direct current, stress corrosion cracking, hydrogen induced cracking, others

— design shortcomings, construction defects or material defects;

— operating errors;

EXAMPLE 4 overpressure, temperature deviation

— maintenance shortcomings;

— hot-tapping by error.

The TSO shall assess the safety aspects listed above. The TSO shall further assess any other safety aspect that might be applicable to its infrastructure and in its specific surroundings. The TSO shall make reference to its own experience, incident data on similar pipelines, national or international incident databases or recognised publications in this field, as appropriate.

The TSO shall define the relevant safety aspects based on the above analysis. These shall be input for the PIMS programmes.

5.3 Preparation of PIMS programmes

The TSO shall have methodologies with which it can manage the defined safety aspects. For these methodologies, reference is made to 5.4.2.

The methodologies shall be based on applicable regulatory requirements, in-house experiences or shared experience with other TSOs, European, national, international standards, codes of practice and/or industry guidelines.

Based on the methodologies the TSO shall define integrity programmes and acceptance criteria.

The objectives of these programmes are to:

— keep the pipelines fit for service;

— prevent damage to the pipelines;

— carry out measurements of the parameters that indicate the pipelines' integrity;

— assess the integrity of the pipelines;

— respond by a predefined set of measures for intervention in the case that an anomaly is detected;

— gather data for the SMS and PIMS.

An appropriate schedule for each of the different programmes shall be defined by the TSO.

The TSO shall record the progress of these programmes.

5.4 Application of integrity programmes

5.4.1 Gathering data

The TSO shall collect the data and information according to the defined PIMS programmes. The TSO shall specify the type, amount and quality of data needed to assess the pipeline integrity. The TSO shall also gather data as required by law or ordinance, technical rules and standards that apply to the gathering and documentation of data.

The TSO shall define the data sources which can be either internal or external sources. They shall, amongst others, include the design and construction phase. The TSO shall define the activities necessary to generate the necessary data from these sources.

When there is insufficient data or when the data quality is low, conservative assumptions shall be made for the integrity assessment process.

All data gathered and reports used for the purpose of integrity assessment shall be stored in an appropriate way and shall be made available in the integrity assessment process.

Geographical and pipeline location data can be made available via a geographical information system (GIS).

5.4.2 Methodologies to ensure and monitor pipeline integrity

5.4.2.1 Typical methodologies

Typical methodologies used to ensure and monitor pipeline integrity are:

— surveillance and pipeline route inspection;

EXAMPLE 1 by air, car, foot, etc.

— operational parameter monitoring;

EXAMPLE 2 pressure, temperature and gas quality monitoring

— monitoring of cathodic protection performance;

— maintenance;

— pipeline inspection;

EXAMPLE 3 inline inspection, direct assessment, indirect assessment

— geological surveys;

— supervision of (authorised) activities near the pipelines.

For further details, refer to EN 1594.

5.4.2.2 Pipeline route surveillance and inspection

The prime aim of pipeline route surveillance is to prevent third party interference.

The prime aim of pipeline route inspection is to check for encroachment.

Another aim of these activities can be to detect leaks.

For this, the TSO shall organise surveillance and inspection of the surroundings of the pipeline to:

a) check for unauthorised objects or unauthorised activities in the vicinity of the pipeline;

EXAMPLE 1 unauthorised objects can be: trees, buildings, festival tents, etc.

b) check for indications of changes in ground profile;

c) check the marker posts;

d) inspect specific points (river banks, aboveground crossings, quarries, etc.).

The TSO shall define the frequency of the surveillance and inspection activities.

The TSO shall have a process for effective communication between concerned parties about the location of its pipelines in the case of activities, such as excavations, and new developments near the pipelines.

EXAMPLE 2 concerned parties: contractors, land owners, town councils, residents, etc.

5.4.2.3 Operational parameter monitoring

The aim of operational parameter monitoring is to monitor the primary parameters that affect operations and safety. Typical operational parameters are:

— operating pressure;

— gas quality;

— gas flow;

— signals from detection systems;

— operating temperature.

5.4.2.4 Monitoring of cathodic protection performance

The TSO protects its underground pipeline infrastructure against external corrosion by providing cathodic protection according to appropriate standards. The effectiveness of cathodic protection shall be regularly monitored, following the applicable international or national rules and standards. Data from monitoring of cathodic protection performance shall be appropriately stored.

EXAMPLE operational data of rectifiers and decoupling devices, on/off-potential measurements, pipe current measurements, casing measurements, coating and cathodic protection above ground surveys, etc.

Where necessary, the TSO shall monitor the cathodic protection data and take them into account, where necessary, in the integrity assessment process.

5.4.2.5 Maintenance

The TSO shall schedule and perform maintenance activities in line with EN 1594 and further appropriate rules and standards and considering the identified safety aspects for pipeline integrity.

The result of maintenance activities affecting the integrity of the pipeline (such as repairs) shall be documented and taken into account in the integrity assessment process.

5.4.2.6 Pipeline inspection

5.4.2.6.1 General

The TSO shall follow its pipeline inspection programme and schedule and perform inspection activities that can consist of internal line inspection (ILI) or direct or indirect assessment.

5.4.2.6.2 Internal line inspection

The TSO shall define which of its pipelines will be inspected by internal line inspection. The TSO shall define the type of measuring technique and resolution required and the inspection intervals. The reasons for selection of the measuring technique with regard to the identified safety aspects for pipeline integrity shall be documented.

In order to carry out safe and effective internal line inspection consideration shall be given to the following:

a) gas flow limits;

b) maximum allowable variation of the pipe inside diameter;

c) permitted ovality;

d) minimum bend radius;

e) valves;

f) tees and other components.

For internal line inspections, various measuring techniques are available:

— magnetic flux leakage (MFL);

— ultrasonic testing (UT);

— electromagnetic acoustic transducer (EMAT);

— geometry tools (e.g. calliper pigs);

— others.

5.4.2.6.3 Direct assessment or indirect assessment

The TSO shall inspect its pipelines which are not inspected by internal line inspection by either direct or indirect assessment.

Types of direct or indirect assessments are:

— external corrosion direct assessment (ECDA);

— internal corrosion direct assessment (ICDA);

— stress corrosion cracking direct assessment (SCCDA);

— cathodic protection measurements (indirect assessment based on electrical surveys).

EXAMPLE direct current voltage gradient (DCVG), Pearson, close interval potential survey (CIPS), others

— hydro testing (indirect assessment);

— others.

NOTE These inspection techniques provide only indirect information about the pipelines' integrity. However, when results from indirect inspection techniques are combined with direct inspections as prescribed in ECDA, this is than considered as direct assessment of the pipeline integrity.

5.4.2.7 Geological surveys

In specific areas, where ground movements can occur, the TSO shall consider geological surveys, monitoring of pipeline strains and displacements or monitoring of soil displacements.

5.4.2.8 Supervision of (authorised) activities near the pipelines

The TSO shall consider supervision of its pipelines in the case of excavation or construction activities or other events that take place near its pipelines. This is in order to prevent that the pipelines will be damaged as a result of these activities.

In particular the communication with third parties, the way the pipeline is marked and the periods when the TSO shall be present during the works, shall be considered.

The degree of supervision, provision of information and the way the pipeline is marked shall take into account the perceived safety aspects of the activity and also the legal and mandatory obligations of third parties.

NOTE The authorisation of activities near the pipeline is given by the TSO after notification. In some countries this authorisation is given by authorities.

5.5 Integrity assessment

The integrity assessment phase consists of the assessment of the results obtained from the programmes identified in 5.3 and the comparison of these results with the, objectives, targets and acceptance criteria in order to verify the effectiveness of the PIMS.

The assessment and comparison shall be carried out taking into account procedures, technical instructions and tools. It shall cover the following elements:

a) the progress of the activities to ensure and monitor the pipeline integrity which are defined in the PIMS programmes;

b) the review of the collected data in order to verify the quality and consistency of the data;

c) pipeline incidents;

d) the recording of the results from these activities;

e) the assessment models and if necessary acceptance criteria for analysing the results of these activities.

5.6 Mitigation

5.6.1 General

The aim of the mitigation phase is to define an intervention programme. This includes, where appropriate:

— repairing or modifying the pipeline;

— modifying the surroundings of the pipeline;

— identifying and implementing improvements to the PIMS.

5.6.2 Repair and modification

The TSO shall have repair procedures. These shall cover the selection of repair techniques according to the severity of the defect or the damage. They shall also cover the safe execution of repairs or modifications.

Repairs shall reinstate the intended integrity of the pipeline at the location of the defect or the damage.

NOTE Pipeline defects and damage can be categorised as follows:

- pipe wall defects (such as corrosion, cracks, dents, gouges, laminations, weld defects);

- pipe coating defects (such as coating disbondment, open coating defects);

- loss of support (such as spanning of pipelines);

- pipe movement (such as plastic deformation).

Modification to the pipeline or its surroundings can be necessary:

— when the available inspection methods for the encountered safety aspect are not practicable for the particular pipeline;

EXAMPLE 1 detection of cracks in a non-pigable pipeline

— when certain safety aspects cannot be dealt with effectively by maintenance activities.

EXAMPLE 2 change in surroundings after design, e.g. land slip or geological activities.

5.6.3 Adjusting operational conditions

5.6.3.1 General

The TSO shall consider adjusting operational conditions if deemed necessary to maintain the integrity of the pipeline.

EXAMPLE operational conditions: operational pressures, temperatures, etc.

5.6.3.2 Prevention activities and systems

Some incidents, defects or types of damage can be prevented by further improvements to procedures or technical systems. The TSO shall have a review process with the objective of identifying and implementing improvements to the relevant PIMS procedures regarding:

a) design and construction (company) standards;

b) operational, maintenance and inspection procedures;

c) preventative activities and systems as a part of the mitigation phase.

Bibliography

[1] EN 1776, *Gas supply systems - Natural gas measuring stations - Functional requirements*

[2] EN 12186, *Gas supply systems - Gas pressure regulating stations for transmission and distribution - Functional requirements*

[3] EN 12583, *Gas supply systems - Compressor stations - Functional requirements*

[4] EN ISO 14001, *Environmental management systems - Requirements with guidance for use (ISO 14001)*

[5] OHSAS 18001, *Occupational health and safety management systems — Requirements*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™