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Petroleum and natural gas industries — Offshore production installations — Major accident hazard management during the design of new installations

Industries du pétrole et du gaz naturel — Installations des plates-formes en mer — Lignes directrices relatives aux outils et techniques pour l'identification et l'évaluation des risques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

This second edition cancels and replaces the first edition (ISO 17776:2000), which has been technically revised and the title changed from *Petroleum and natural gas industries — Offshore production installations — Guidelines on tools and techniques for hazard identification and risk assessment* to the present title.

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Introduction

The purpose of this document is to establish requirements and provide guidance for the effective management of major accident (MA) hazards during the design of new offshore installations for the petroleum and natural gas industries.

The management of MA hazards involves the application of engineering expertise and knowledge to provide the measures needed to meet the objectives set by the organizations involved in the project development. A range of tools for evaluating and assessing the likelihood and consequences of MAs is needed to help select the measures to be implemented, and to judge when sufficient measures have been provided.

This process is built on the underlying integrity provided by the application of internationally recognized codes and standards.

This document covers the following main elements:

— establishing general requirements for identifying MA hazards and their causes;

— assessing MA hazards to understand their likelihood and possible consequences;

— developing suitable strategies for managing MA hazards;

— progressively improving the understanding of MA hazards and their consequences to guide design decisions during the development phases of the installation;

— providing the measures needed to manage all credible MAs;

— maintaining the measures throughout the life of the installation.

The technical content of this document is arranged as follows:

a) objectives: the goals to be achieved;

b) functional requirements: specifying requirements considered necessary to meet the stated objectives;

c) annexes: guidelines in support of the functional requirements.

This document should be read in conjunction with ISO 13702 and ISO 15544.

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Petroleum and natural gas industries — Offshore production installations — Major accident hazard management during the design of new installations

1 Scope

This document describes processes for managing major accident (MA) hazards during the design of offshore oil and gas production installations. It provides requirements and guidance on the development of strategies both to prevent the occurrence of MAs and to limit the possible consequences. It also contains some requirements and guidance on managing MA hazards in operation.

This document is applicable to the design of

— fixed offshore structures, and

— floating systems for production, storage and offloading

for the petroleum and natural gas industries.

The scope includes all credible MA hazards with the potential to have a material effect on people, the environment and assets.

This document is intended for the larger projects undertaken to develop new offshore installations. However, the principles are also applicable to small or simple projects or design changes to existing facilities and can also be relevant to onshore production facilities.

Mobile offshore units as defined in this document are excluded, although many of the principles can be used as guidance. The design of subsea facilities are also excluded, though the effects of mobile and subsea facilities are considered if they can lead to major accidents that affect an offshore installation. This document does not cover the construction, commissioning, abandonment or security risks associated with offshore installations.

The decision to apply the requirements and guidance of this document, in full or in part, is intended to be based on an assessment of the likelihood and possible consequences of MA hazards.

2 Normative references

The following documents are referred to in text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 31000, *Risk management — Principles and guidelines*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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3.1.1
barrier
functional grouping of safeguards or controls selected to prevent a major accident or limit the consequences

Note 1 to entry: Barriers can be subdivided into hardware barriers or human barriers and are supported by management system elements.

Note 2 to entry: Adapted from IOGP Report No. 415.

3.1.2
emergency response
action taken by personnel on or off an installation to limit the consequences of a major accident or initiate and execute abandonment

[SOURCE: ISO 15544:2000, 2.1.8]

3.1.3
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships

Note 1 to entry: Surroundings can extend from within an organization to the local, regional and global system.

Note 2 to entry: Surroundings can be described in terms of biodiversity, ecosystems, climate or other characteristics.

[SOURCE: ISO 14001:2015, 3.2.1]

3.1.4
ergonomics
scientific discipline concerned with study of human factors and understanding of interactions among human and other elements of a system

Note 1 to entry: Adapted from ISO 6385:2004.

3.1.5
escape route
route from an area of an installation leading to a muster area, temporary refuge (TR), embarkation area, or means of escape to the sea

[SOURCE: ISO 15544:2000, 2.1.15]

3.1.6
evacuation
planned method of leaving the installation in an emergency

[SOURCE: ISO 15544:2000, 2.1.17]

3.1.7
harm
injury or damage to the health of people, or damage to property or the environment

[SOURCE: ISO/IEC Guide 51:2014, 3.1]

3.1.8
hazard
potential source of harm

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

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3.1.9
hazardous event
event that can cause harm

[SOURCE: ISO/IEC Guide 51:2014, 3.3]

3.1.10
individual risk
risk to which an individual is exposed during a defined period of time

3.1.11
inherently safer design
design which eliminates or reduces major accidents through measures that are permanent and inseparable from the design

3.1.12
major accident
MA
hazardous event that results in

— multiple fatalities or severe injuries; or

— extensive damage to structure, installation or plant; or

— large-scale impact on the environment (e.g. persistent and severe environmental damage that can lead to loss of commercial or recreational use, loss of natural resources over a wide area or severe environmental damage that will require extensive measures to restore beneficial uses of the environment)

Note 1 to entry: In this document, a major accident is the realization of a major accident hazard.

Note 2 to entry: This definition is intended to incorporate terms such as “major accident” as defined by UK HSE.

3.1.13
major hazard
hazard with the potential, if realized, to result in a major accident

3.1.14
mobile offshore unit
mobile platform, including drilling ships, equipped for drilling for subsea hydrocarbon deposits and mobile platforms for purposes other than production and storage of hydrocarbon deposits

Note 1 to entry: Includes mobile offshore drilling units, drill ships, accommodation units, construction and pipe-lay units, well servicing and well stimulation vessels.

3.1.15
muster area
designated area to which personnel report when required to do so in an emergency

[SOURCE: ISO 15544:2000, 2.1.29]

3.1.16
performance standard
measureable statement, expressed in qualitative or quantitative terms, of the performance required of a system, item of equipment, person or procedure, and that is relied upon as a basis for managing a hazard

Note 1 to entry: Hardware performance standards address the functionality, reliability, survivability and interdependency of barriers under emergency conditions.

[SOURCE: IOGP Report No. 415]

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3.1.17
risk
combination of the probability of occurrence of harm and the severity of that harm

Note 1 to entry: A more general definition of risk is given in ISO Guide 73:2009 and is "effect of uncertainty" where:

— an effect is a deviation from the expected, and

— uncertainty is a state of having limited knowledge where it is impossible to exactly describe the existing state and future outcomes.

[SOURCE: ISO/IEC Guide 51:2014, 3.9, modified, Note 1 to entry has been replaced with another note.]

3.1.18
risk criteria
terms of reference against which the significance of risk is evaluated

Note 1 to entry: Risk criteria are based on organizational objectives, and external and internal context.

Note 2 to entry: Risk criteria can be derived from standards, laws, policies and other requirements.

[SOURCE: ISO Guide 73:2009, 3.3.1.3]

3.1.19
risk tolerance
organization's readiness to bear the risk after risk treatment in order to achieve its objectives

Note 1 to entry: Risk tolerance can be influenced by legal or regulatory requirements.

Note 2 to entry: Qualitative or quantitative criteria can be used to help the organization decide if a risk is tolerable

[SOURCE: ISO Guide 73:2009, 3.7.1.3, modified – Note 2 to entry has been added.]

3.1.20
temporary refuge
TR
place provided where personnel can take refuge for a predetermined period while investigations, emergency response and evacuation preparations are undertaken

[SOURCE: ISO 15544:2000, 2.1.37, modified, Note 1 to entry has been omitted.]

3.2 Abbreviated terms

CFD computational fluid dynamics

EER escape, evacuation and rescue

ESD emergency shutdown

FMECA failure mode, effects, and criticality analysis

HAZID hazard identification study

HAZOP hazard and operability study

IOGP International Association of Oil and Gas Producers (previously: OGP)

ISD inherently safer design

JHA job hazard analysis

MA major accident

MOC management of change

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P&ID piping and instrument diagram

PFD probability of failure on demand

QRA quantitative risk analysis

TR temporary refuge

4 Major accident hazard management overview

4.1 General

The process to manage MA hazards shall align with the principles and framework set out in ISO 31000 and shall

— establish the context prior to starting or executing any of the elements of the process,

— update the context throughout the process, and

— apply a thorough process for communicating, consulting, monitoring and review.

In developing the context for managing MA hazards, "lessons learned" from other organizations, accident reports and general safety bulletins made available for public review shall be taken into account where these identify additional hazards, additional measures, or highlight deficiencies in the current measures for the management of MA hazards on offshore installations. This is part of an improvement effort which requires users to seek opportunities for improving their designs on a continual basis.

A process to manage MA hazards shall be applied throughout all stages of a project. Designs shall be regularly reviewed during their development and changed as necessary to achieve the strategies developed to meet the objectives and risk criteria.

Modifications to an existing installation shall be conducted under an appropriate management of change (MOC) process. To assess how any modification can change the likelihood or consequences of an MA, a good understanding is needed of the existing MA hazards and any new MA hazards introduced by the change. It is also necessary to understand the effectiveness of the current strategies to manage the existing MA hazards, in order to avoid compromising design measures already implemented to reduce risk.

If strategies for managing the MA hazards are not available, the requirements and guidance provided in this document shall be used to identify the existing MA hazards and develop suitable strategies to manage them.

The outcome of this process is the measures necessary to manage each MA hazard for the life cycle of the installation. In order to determine the most effective range of design measures, a systematic analysis, using a range of tools and techniques, shall be used to evaluate the likelihood and consequences of each identified MA hazard.

An integral part of decision-making is a framework which allows judgement of when the risks to human beings, the environment and assets are reduced to a tolerable level. Effective decision-making requires a transparent process which promotes dialogue and engagement with stakeholders to assist in identifying where improvements can be made in managing MA hazards. An example of a framework to support decision making is given in Annex A.

4.2 Project management commitment

Project managers shall establish a broad view of the context of the proposed project and the associated risks to people, the structure, installation or plant and the environment over the lifetime of installation and beyond.

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