SIST

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Petroleum and natural gas industries - Offshore production installations - Guidelines on tools and techniques for hazard identification and risk assessment (ISO 17776:2000)

Petroleum and natural gas industries - Offshore production installations - Guidelines on tools and techniques for hazard identification and risk assessment (ISO 17776:2000)

Erdöl- und Erdgasindustrie - Offshore-Produktionsanlagen - Leitfaden für Hilfsmittel und Verfahren zur Gefahrenerkennung und Risikobeurteilung (ISO 17776:2000)

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 (ISO 17776:2000)

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Petroleum and natural gas industries - Offshore production installations - Guidelines on tools and techniques for hazard identification and risk assessment (ISO 17776:2000)

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This European Standard was approved by CEN on 3 January 2002.

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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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Foreword

The text of the International Standard from Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" of the International Organization for Standardization (ISO) has been taken over as a European Standard by Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries", the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by September 2002, and conflicting national standards shall be withdrawn at the latest by September 2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 17776:2000 has been approved by CEN as a European Standard without any modifications.

INTERNATIONAL STANDARD

ISO 17776

First edition
2000-10-15

Petroleum and natural gas industries — Offshore production installations — Guidelines on tools and techniques for hazard identification and risk assessment

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 17776 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum and natural gas industries*, Subcommittee SC 6, *Processing equipment and systems*.

Annexes A, B, C and D of this International Standard are for information only.

Introduction

Oil and gas exploration and production activities have many hazards and hazardous events associated with them.

Different tools and techniques can be used to identify and assess hazards and risks, and it is important that the approach selected is appropriate to the particular circumstances.

This International Standard identifies some of the tools and techniques that may be used for this purpose in the offshore exploration and production industry and gives guidance on how they may be applied to particular activities. This International Standard incorporates advice and guidance given in other documents used in the industry, some of which are cited in the Bibliography.

This International Standard does not provide a detailed description of the practical application of the various tools and techniques, as this will need to be specifically developed to deal with particular circumstances. In many cases expert advice from competent practitioners will be required to effectively apply the tools and techniques described in this International Standard.

Petroleum and natural gas industries — Offshore production installations — Guidelines on tools and techniques for hazard identification and risk assessment

1 Scope

This International Standard describes some of the principal tools and techniques that are commonly used for the identification and assessment of hazards associated with offshore oil and gas exploration and production activities, including seismic and topographical surveys, drilling and well operations, field development, operations, decommissioning and disposal together with the necessary logistical support of each of these activities. It provides guidance on how these tools and techniques can be used to assist in development of strategies both to prevent hazardous events and to control and mitigate any events that may arise.

This International Standard is applicable to:

— fixed offshore structures;

— floating production, storage and off-take systems;

for the petroleum and natural gas industries.

This International Standard is not applicable to design and construction aspects of mobile offshore units that fall under the jurisdiction of the International Maritime Organization.

This International Standard is not intended to be used as part of certification criteria, and no defect in the management of risks should be inferred if any of the tools and techniques covered by this International Standard are not applied to an installation.

2 Terms, definitions and abbreviated terms

For the purpose of this International Standard, the following terms, definitions and abbreviated terms apply.

2.1 Terms and definitions

2.1.1
barrier
measure which reduces the probability of realizing a hazard's potential for harm and which reduces its consequence

NOTE Barriers may be physical (materials, protective devices, shields, segregation, etc.) or non-physical (procedures, inspection, training, drills, etc.).

2.1.2
control
〈of hazards〉 limiting the extent and/or duration of a hazardous event to prevent escalation

2.1.3
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation

2.1.4
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services

2.1.5
escalation
spread of the impact of a hazardous event to equipment or other areas, thereby causing an increase in the consequences of the event

2.1.6
event tree
event tree analysis
ETA
tree-like diagram used to determine alternative potential scenarios arising from a particular hazardous event

NOTE It can be used quantitatively to determine the probability or frequency of different consequences arising from the hazardous event.

2.1.7
fault tree
fault tree analysis
FTA
tree-like diagram based upon the application of "and/or" logic used to identify alternative sequences of hardware faults and human errors that result in system failures or hazardous events

NOTE When quantified, fault trees allow system-failure probability or frequency to be calculated.

2.1.8
functional requirements
minimum criteria which should be satisfied to meet the stated health, safety and environmental objectives

NOTE See 5.4.2 for further information.

2.1.9
hazard
potential source of harm

NOTE In the context of this International Standard, the potential harm may relate to human injury, damage to the environment, damage to property, or a combination of these.

2.1.10
hazards register
document providing a brief, but complete, overview of the identified hazards and the measures necessary to manage them

NOTE The hazards register also provides references to more detailed information relevant to a particular hazard.

2.1.11
hazardous event
incident which occurs when a hazard is realized

EXAMPLES Release of gas, fire, loss of buoyancy.

2.1.12
incident
accident
event or chain of events which cause, or could have caused, injury, illness and/or damage (loss) to assets, the environment or third parties

2.1.13
mitigation
limitation of the undesirable effects of a particular event

2.1.14
procedure
series of steps to be carried out in a logical order for a defined operation or in a given situation

2.1.15
risk
combination of the probability of an event and the consequences of the event

2.1.16
risk analysis
use of available information to identify hazards and to estimate risk

2.1.17
risk assessment
overall process of risk analysis and risk evaluation

2.1.18
risk evaluation
judgement, on the basis of risk analysis, of whether a risk is tolerable

2.1.19
screening criterion
target or standard used to judge the tolerability of an identified hazard or effect

NOTE See 5.3.2 for further information.

2.1.20
tolerable risk
risk which is accepted in a given context based on the current values of society

2.1.21
top event
particular hazardous event considered in the development of fault and event trees

2.2 Abbreviated terms

CBA cost-benefit analysis

CFD computational fluid dynamics

EERA escape, evacuation and rescue analysis

ESD emergency shutdown

ETA event tree analysis

FMEA failure modes and effects analysis

FTA fault tree analysis

HAZAN hazard analysis

HAZID hazard identification

HAZOP hazard and operability study

HEMP hazard effect and management process

HRA health risk assessment

HSE health, safety and environment

JHA job hazard analysis

LNG liquefied natural gas

LPG liquefied petroleum gas

P&ID process and instrument diagram

PHA preliminary hazard analysis

PEM physical effects modelling

QRA quantitative risk assessment

SAR search and rescue

SIL safety integrity level

3 Hazards and risk assessment concepts

Effective management systems are required to address the health and safety aspects of the activities undertaken by all companies associated with the offshore recovery of hydrocarbons[1)]. These management systems should be applied to all stages in the life cycle of an installation and to all related activities. Such a management system, which has been developed for environmental issues, is described in ISO 14001 [3] and the principles contained in this International Standard can also be applied to issues relating to health and safety.

One key element of effective management systems is a systematic approach to the identification of hazards and the assessment of the associated risk in order to provide information to aid decision-making on the need to introduce risk-reduction measures.

Risk-reduction measures should include those to prevent incidents (i.e. reduce the probability of occurrence), to control incidents (i.e. limit the extent and duration of a hazardous event) and to mitigate the effects (i.e. reduce the consequences). Preventive measures, such as using inherently safer designs and ensuring asset integrity, should be emphasized wherever practicable. Measures to recover from incidents should be provided based on risk assessment and should be developed taking into account possible failures of the control and mitigation measures. Based on the results of the evaluation, detailed health, safety and environmental objectives and functional requirements should be set at appropriate levels.

1) For example, operators should have an effective management system. Contractors should have either their own management system or conduct their activities consistently with the operator's management system.

ISO 13702 [2] introduced the concept of strategies, but stated that such strategies do not have to be separately documented as the relevant information may be included with other HSE information for an installation or may be contained in recognized codes and standards that are relevant to the operating location. Indeed there can be significant overlap between strategies and other HSE information, so that combining this information into one source is likely to assist the understanding by the people on the installation of how the various measures are integrated.

The results of the hazard identification and risk assessment activities and the decisions taken with respect to the need for, and role of, any measures required for risk reduction should be recorded in strategies.

Hazards identification and risk assessment involves a series of steps as described below.

a) **Step 1: Identification of the hazard,** based upon consideration of factors such as the physical and chemical properties of the fluids being handled, the arrangement of equipment, operating and maintenance procedures and processing conditions. External hazards such as ship collision, extreme environmental conditions, helicopter crash, etc. also need to be considered at this stage.

b) **Step 2: Assessment of the risk** arising from the hazards and consideration of its tolerability to personnel, the facility and the environment. This normally involves the identification of initiating events, identification of possible accident sequences, estimation of the probability of occurrence of accident sequences and assessment of the consequences. The acceptability of the estimated risk must then be judged based upon criteria appropriate to the particular situation.

c) **Step 3: Elimination or reduction of the risk** where this is deemed to be necessary. This involves identifying opportunities to reduce the probability and/or consequence of an accident.

These three generic steps are inherent in all the methods which are described in this International Standard.

In selecting the appropriate hazard identification and risk assessment tools and techniques, the nature and scale of the installation, the stage in the life cycle and experience of similar installations should all be considered. The level of effort devoted to hazard identification and risk assessment should be based on the anticipated level of risk, the novelty of the undertaking and any limitations in knowledge.

Where the more complex, structured review techniques are used, the uncertainties in the assumptions used must be appreciated and considered when assessing necessary risk-reduction measures. It is important that uncertainties in the assumptions are well documented and communicated to the personnel who are using the results of the hazards and risk assessment to assist in decision-making.

For new installations or activities it is important to identify hazards as early as possible, in order that sufficient time can be given to the study and evaluation of the hazard before determining the most appropriate solution to manage it. It is always easier to make modifications early in the design stage of a project, when changes can be made with minimal effect on cost and schedule.

Hazards and risk assessment can also be applied to existing facilities, but in some cases changes that would be justified during design may not be practicable for an existing facility. As an example, improvements in layout concepts may not be practicable for existing facilities. The work necessary in undertaking modifications to an existing facility in itself introduces an additional risk of an accident which needs to be considered.

Figure 1 shows approaches with differing levels of complexity that may be used for hazards and risk assessment.