BS EN ISO 13702:2024

BSI Standards Publication

Oil and gas industries — Control and mitigation of fires and explosions on offshore production installations — Requirements and guidelines

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The UK participation in its preparation was entrusted to Technical Committee PSE/17/-/6, Processing equipment and systems for petroleum and natural gas industries.

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

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Oil and gas industries - Control and mitigation of fires and explosions on offshore production installations - Requirements and guidelines (ISO 13702:2024)

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Erdöl- und Erdgasindustrie - Überwachung und Eindämmung von Feuer und Explosionen auf Offshore-Produktionsplattformen - Anforderungen und Leitlinien (ISO 13702:2024)

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European foreword

This document (EN ISO 13702:2024) has been prepared by Technical Committee ISO/TC 67 "Oil and gas industries including lower carbon energy" in collaboration with Technical Committee CEN/TC 12 “Oil and gas industries including lower carbon energy” the secretariat of which is held by NEN.

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of an identical text or by endorsement, at the latest by September 2024, and conflicting national standards shall be withdrawn at the latest by September 2024.

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Foreword

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 67, *Oil and gas industries including lower carbon energy*, Subcommittee SC 6, *Process equipment, piping, systems, and related safety,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 12, *Oil and gas industries including lower carbon energy,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 13702:2015), which has been technically revised.

The main changes are as follows:

— visualized the risk treatment process in a flow diagram in 5.8;

— improved description of the explosion blast description in Clause A.3;

— improved guidance with respect to risk mitigation in Clause B.1;

— introduction of ESD hierarchy and guidance related to principles to protect pressurised equipment against fire in Clause B.2;

— improved guidance on ignition source control in Clause B.3;

— included guidance for control of spills related to floating LNG in Clause B.4;

— expanded guidance related to gas detection in Clause B.6;

— included guidance related to ignition source control for firewater pump drivers and external power supplies in B.8.2;

— addressing personnel safety related to CO_2 or other asphyxiating gases in B.8.11;

— introduced guidance related to passive fire-retarding surface for helidecks in B.8.13;

— introduced guidance related to tests in B.13;

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— introduced the terms A-class and H-class for fire barriers in C.4.3.

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Introduction

The successful development of the arrangements required to promote safety and environmental protection during the recovery of hydrocarbon resources requires a structured approach to the identification and management of health, safety, and environmental hazards applied during the design, construction, commissioning, operation, inspection, maintenance, and decommissioning of a facility.

This document has been prepared primarily to assist in the development of new installations through their lifecycle.

The content of this document is arranged as follows.

— Objectives: lists the goals to achieved by the control and mitigation measures being described.

— Functional requirements: represent criteria to meet the stated objectives. The functional requirements are performance-orientated measures and, as such, are applicable to the variety of offshore installations utilized for the development of hydrocarbon resources throughout the world.

— Annex A: describes typical fire and explosion hazardous events.

— Annex B: describes recognized practices that can be considered in conjunction with statutory requirements, industry standards, and individual operator philosophy to determine that the measures necessary are implemented for the control and mitigation of fires and explosions. The guidance is limited to principal elements and are intended to provide specific guidance which, due to the wide variety of offshore operating environments, cannot be applicable in some circumstances.

— Annex C: describes typical examples of design requirements for large integrated offshore installations.

This document is based on an approach where the selection of control and mitigation measures for fires and explosions primarily caused from loss of containment is determined by an evaluation of hazards on the offshore installation. The methodologies employed in this assessment and the resultant recommendations differ depending on the complexity of the production process and facilities, type of facility (i.e. open or enclosed), staffing levels, and environmental conditions associated with the area of operation.

NOTE Requirements, rules, and regulations can, in addition, be applicable for the individual offshore installation concerned.

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1 Scope

This document specifies the objectives and functional requirements for the control and mitigation of fires and explosions on offshore installations used for the development of hydrocarbon resources in oil and gas industries. The object is to achieve:

— safety of personnel;

— protection of the environment;

— protection of assets;

— minimization of financial and consequential losses of fires and explosions.

This document is applicable to the following:

— fixed offshore structures;

— floating systems for production, storage, and offloading.

Mobile offshore units and subsea installations are excluded, although many of the principles contained in this document can be used as guidance.

2 Normative references

The following documents are referred to in the 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 31073, *Risk management — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 31073 and the following apply.

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

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

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

3.1
accommodation
place where personnel onboard sleep and spend their off-duty time

Note 1 to entry: It can include dining rooms, recreation rooms, lavatories, cabins, offices, sickbay, living quarters, galley, pantries, and similar permanently enclosed spaces.

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3.2
active fire protection
AFP
equipment, systems, and methods which, following initiation, can be used to control, mitigate, and extinguish fires

3.3
ALARP
as low as reasonably practicable
implementation of risk-reducing measures until the cost (including time, capital costs or other resources and assets) of further *risk* (3.35) reduction is grossly disproportional to the potential risk reducing effect achieved by implementing any additional measure

Note 1 to entry: See UK HSE[41].

3.4
area classification
division of an installation into *hazardous areas* (3.24) and non-hazardous areas and the sub-division of *hazardous areas* (3.24) into zones under normal operation

Note 1 to entry: This classification is based on the materials that can be present and the probability of a flammable atmosphere developing. Area classification is primarily used in the selection of electrical equipment to minimize the likelihood of ignition if a release occurs.

3.5
cellulosic fire
CF
fire involving primarily cellulosic material such as wood, timber, or paper

3.6
control
limitation of the extent or duration of a *hazardous event* (3.25)

3.7
control station
place from which personnel can monitor the status of the installation, initiate appropriate shutdown actions, and undertake any emergency communication

Note 1 to entry: Control station is typically known as CCR or central point.

3.8
critical safety system
system that has a major role in the prevention and mitigation of releases, fires and *explosions* (3.21) and in any subsequent *escape, evacuation, and rescue* (3.19) activities

3.9
deluge system
system to apply fire-water through an array of open spray nozzles by operation of a valve on the inlet to the system

3.10
embarkation area
place from which personnel leave the installation during *evacuation* (3.18)

EXAMPLE Helideck and associated waiting area or a lifeboat or life raft boarding area.

3.11
emergency depressurization
EDP
controlled disposal of pressurized fluids to a flare or vent system when required to avoid or minimize a *hazardous event* (3.25)

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3.12
emergency response
action taken by personnel on or off the installation to control or mitigate a *hazardous event* (3.25) or initiate and execute abandonment of the facility

3.13
emergency response team
group of personnel who have designated duties in an emergency

3.14
emergency shutdown
ESD
control (3.6) actions undertaken to shut down equipment or processes in response to a *hazardous event* (3.25)

3.15
escalation
spread of impact from fires, *explosions* (3.21), toxic gas releases to equipment or other areas thereby causing an increase in the consequences of the initial *hazardous event* (3.25)

3.16
escape
act of personnel moving away from a hazardous event to a place where its effects are reduced or removed

3.17
escape route
route that provides a safe path from an area of an installation leading to a *muster area* (3.31), *temporary refuge (TR)* (3.37), *embarkation area* (3.10), or means of *escape* (3.16) to the sea

3.18
evacuation
planned method of leaving the installation in an emergency

3.19
escape, evacuation, and rescue
EER
range of possible actions including *escape* (3.16), muster, refuge, *evacuation* (3.18), escape to the sea, and rescue or recovery

3.20
evacuation route
escape route (3.17) that leads from the *temporary refuge (TR)* (3.37) to the place(s) used for *evacuation* (3.18) from the installation

3.21
explosion
event characterized by a rapid release of energy which has the potential to generate high blast overpressures and drag forces, as well as blast waves propagating away from the ignition point

3.22
fire and explosion strategy
FES
results of the process that uses information from the fire and *explosion* (3.21) evaluation to determine the measures required to manage these *hazardous events* (3.25) and the role of these measures

3.23
hazard
potential source of harm

EXAMPLE A source for potential human injury, damage to the environment, damage to property, or a combination of these.

[SOURCE: ISO/IEC Guide 51:2014[13], 3.2, modified — Example has been added.]

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3.24
hazardous area
three-dimensional space in which a flammable atmosphere can be expected to be present at such frequencies as to require special precautions for the *control* (3.6) of potential *ignition sources* (3.27) as a result of *area classification* (3.4) studies

3.25
hazardous event
event that can cause harm

EXAMPLE The incident that occurs when a *hazard* (3.23) is realized such as release of gas, fire, loss of buoyancy.

[SOURCE: ISO/IEC Guide 51:2014[13], 3.3, modified — Example has been added.]

3.26
human factors
environmental, organisational, and job factors that influence behaviour of work in a way that can affect health and safety outcomes including the performance of *critical safety systems* (3.8)

3.27
ignition source
source with sufficient energy to initiate combustion

3.28
integrated installation
offshore installation that contains on the same load-bearing structure *accommodation* (3.1) and utilities, in addition to process or wellhead facilities

3.29
jet fire
JF
turbulent diffusion flame resulting from the combustion of a fuel continuously released with momentum in a particular direction

3.30
mobile offshore unit
mobile platform, including drilling ships, equipped for drilling for subsea hydrocarbon deposits and mobile platform for purposes other than production and storage of hydrocarbon deposits

Note 1 to entry: It includes mobile offshore drilling units, including drill ships, *accommodation* (3.1) units, construction and pipelay units, and well servicing and well stimulation vessels.

3.31
muster area
designated area where personnel report when required to do so

3.32
operator
individual, partnership, firm, or corporation having control or management of operations on the leased area or a portion thereof

Note 1 to entry: The operator can be a lessee, designated agent of the lessee(s), or holder of operating rights under an approved operating agreement.

3.33
passive fire protection
PFP
coating or cladding arrangement or free-standing system which, in the event of fire, will provide thermal protection to restrict the rate at which heat is transmitted to the object or area being protected

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3.34
pool fire
turbulent diffusion fire burning above a horizontal pool of vaporizing flammable or combustible liquid under conditions where the liquid has zero or very low initial momentum

3.35
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:2014[13], 3.9, modified — Note to entry has been removed.]

3.36
running liquid fire
fire involving a flammable liquid flowing over a surface

3.37
temporary refuge
TR
place provided where personnel can take refuge for a predetermined period while investigations, *emergency response* (3.12), and *evacuation* (3.18) preplanning are undertaken

4 Abbreviated terms

AB	accommodation block
API	American Petroleum Institute
BOP	blowout preventer
CCR	central control room
CS	control station
DIFFS	deck integrated fire fighting system
F&G	fire and gas
GOR	gas oil ratio
HC	hydrocarbon
HMI	human machine interface
HVAC	heating, ventilation, and air conditioning
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
PA	public address
SSIV	sub-sea isolation valve
SSSV	sub-surface safety valve
TEMPSC	totally enclosed motor-propelled survival craft
UA	utility area
UPS	uninterruptable power supply

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WH wellhead area

5 Fire and explosion evaluation and risk management

5.1 Management system

All companies associated with the offshore recovery of hydrocarbons shall have, or conduct their activities in accordance with, an effective management system that addresses safety and environmental issues. As an example, operators should have an effective management system; contractors should have either their own management system or conduct their activities consistently with the operators' management system and additionally address issues relating to health and safety. The management system shall include a process of evaluating and managing risk in a framework of policies, procedures and organizational arrangements that embeds the management of risk throughout the organization.

5.2 Risk assessment and the risk management framework

This document assumes that the risk assessment is performed within the principles and guidelines for risk management described in IEC 31010[12].

In particular, those carrying out risk assessments shall be clear about the following:

a) organization's risk management policy, its objectives, and the context in which the organization operates;

b) extent and type of risks that are tolerable and how to treat any risks that are deemed not to be tolerable;

c) how risk assessment integrates into organizational processes;

d) methods and techniques to be used for risk assessment and their contribution to the risk management process;

e) accountability, both for performing risk assessment and for making decisions taking account of the results;

f) resources required to carry out risk assessment;

g) how the risk assessment will be reported, reviewed and audited.

5.3 Risk assessment process

Risk assessment provides decision-makers and responsible parties with an improved understanding of risks that can affect achievement of objectives and the adequacy and effectiveness of controls planned or already in place. This provides a basis for decisions about the most appropriate approach to be used to manage the risks. The output of risk assessment is an input to the decision-making processes of the organization.

Risk assessment is the overall process of hazard identification, risk analysis, and risk evaluation. The way this process is applied depends on the context of the risk management process and on the methods and techniques used to carry out the risk assessment.

5.4 Hazard identification

The starting point for risk management is the systematic identification of the sources of hazards and their potential consequences which can be dependent on the location, activities, and materials which are used or encountered in them.

The hazard identification process shall be applied to all stages in the life cycle of an installation and to all types of hazards encountered as a consequence of the development of hydrocarbon resources.

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5.5 Risk analysis

Risk analysis involves developing an understanding of the risks associated with the hazards identified. Risk analysis provides an input to risk evaluation and to decisions on whether risks need to be treated, and on the most appropriate risk treatment strategies and methods. Risk analysis can also provide an input into making decisions where choices are made, and the options involve different types and levels of risk.

Risk analysis involves consideration of the causes and sources of risk, their positive and negative consequences, and the likelihood that those consequences can occur. Factors that affect consequences and likelihood shall be identified. An event can have multiple consequences and can affect multiple objectives. Existing controls and their effectiveness and efficiency shall also be considered.

Unless a conservative approach is being taken (e.g. worst-case scenarios or pessimistic assumptions in the risk analysis), the risk analysis should address uncertainties in frequencies and consequences, e.g. in data and models, applied through an uncertainty or sensitivity analysis.

5.6 Risk evaluation

The purpose of risk evaluation is to assist decision-making and should be based on the outcomes of risk analysis.

Risk evaluation involves comparing the level of risk found during the analysis process with qualitative or quantitative criteria established when the context was considered. Based on this comparison, the need for treatment shall be considered.

Decisions shall take account of the wider context of the risk and include consideration of the tolerance of the risks borne by parties other than the organization that get benefits from the risk.

In some circumstances, the risk evaluation can lead to a decision to undertake further analysis or to consider other options. The risk evaluation can also lead to a decision not to treat the risk in any way other than maintaining existing controls. This decision will be influenced by the organization's risk tolerance and the criteria that have been established.

5.7 Risk treatment

5.7.1 General

The general hierarchy of risk reduction measures to implement is usually as follows:

— elimination (remove the hazard);

— substitution (of a lower risk alternative);

— engineering controls:

  — layout (segregation or separation);

  — passive barriers;

  — active barriers (preference for fail safe design);

— administrative controls (procedures);

— personal protective equipment (PPE).

Risk treatment involves selecting one or more options for modifying risks and implementing those options. Once implemented, treatments provide or modify the controls.

Risk treatment involves a cyclical process of

— assessing a risk treatment,

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— deciding whether residual risk levels are reduced to ALARP and which then can be deemed tolerable,

— generating a new risk treatment, if risk levels are not tolerable, and

— assessing the effectiveness of that treatment.

Risk treatment options are not necessarily mutually exclusive or appropriate in all circumstances. The options can include the following:

a) avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk;

b) taking or increasing the risk in order to pursue an opportunity;

c) removing the hazard source – inherently safe;

d) changing the likelihood; e.g. through improved knowledge;

e) changing the consequences; e.g. through more robust modelling or improved barriers;

f) retaining the risk by informed decision;

g) reducing the risk by deciding to decrease production, assuming losses.

The process of selecting risk treatment measures predominantly entails the use of sound engineering judgement, but it can be necessary to supplement this by recognition of the particular circumstances which can require deviation from past practices and previously applied codes and standards.

5.7.2 Prioritization of risk treatment measures

Preventative measures, such as using inherently safer designs and ensuring asset integrity, shall be emphasized wherever practicable. Based on the results of the evaluation, detailed health, safety, and environmental objectives, the functional requirements shall be set at appropriate levels.

5.8 Risk treatment in the context of offshore oil and gas operations

5.8.1 General

The development of a fire and explosion strategy (FES) is an iterative process that typically starts early in the design phase of a facility and is refined as the project progresses and more detailed information becomes available.

The objectives and functional requirements of the safety systems reported in Clause 6 to Clause 16 constitute a set of recommended minimum criteria applicable to the design of offshore installations. Then, following the identification of the minimum design requirements and the development of the preliminary project documentation, the risk management process shall be applied throughout the different project phases in order to ensure that risks are reduced to ALARP, as it is summarized in Figure 1.

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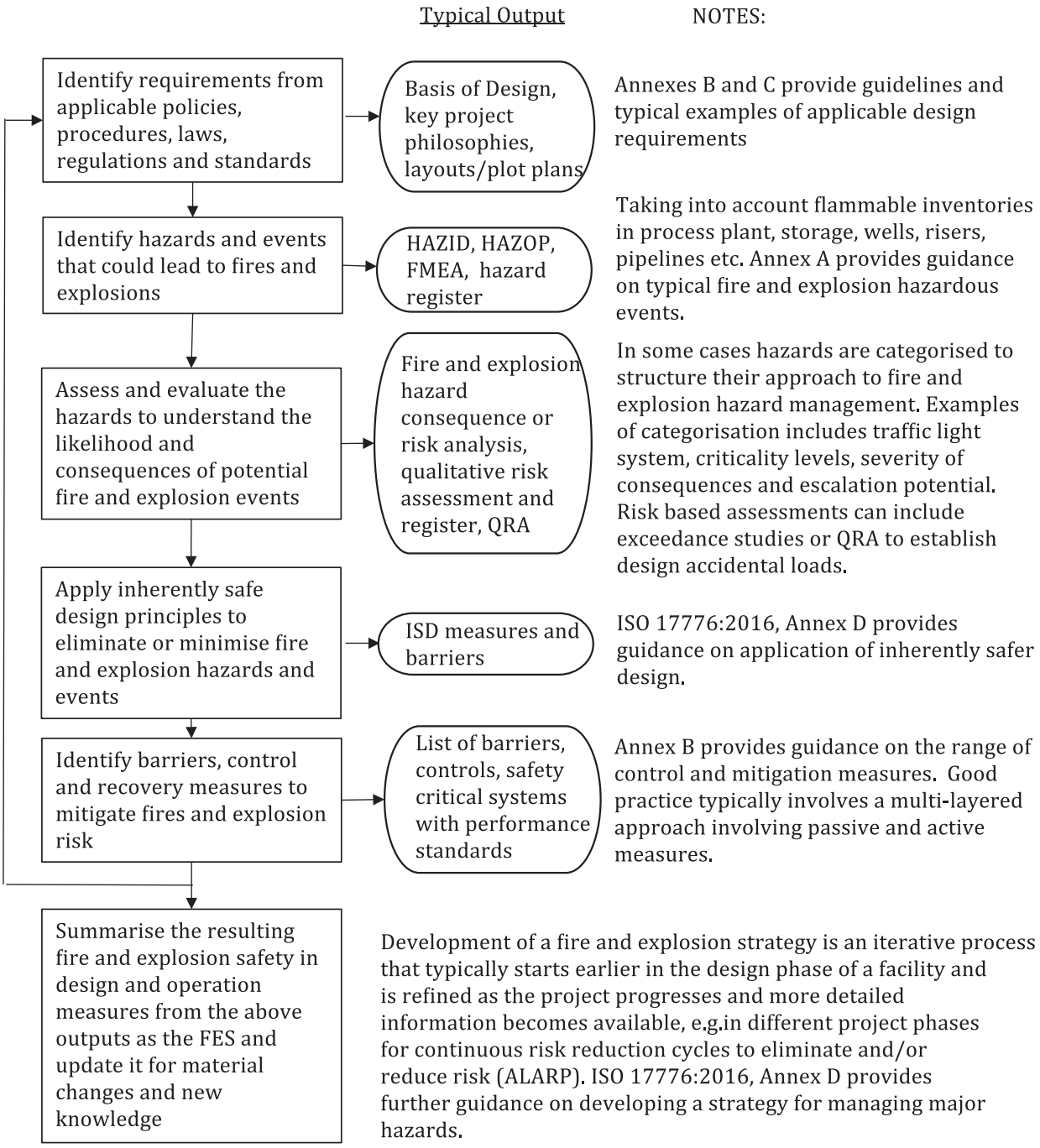

Figure 1 — Workflow

The workflow in Figure 1 is general and applies to all hazards and potentially hazardous events. In the context of fires and explosions, the evaluation of these events may be part of an overall installation evaluation or may be treated as a separate process which provides information to the overall evaluation. For further requirements and guidance related to hazard identification and risk assessment see ISO 17776[5].

In developing the risk treatment measures, there is a wide range of issues which shall be considered to ensure that the measures selected can perform their function when required to do so. These issues include the following:

a) nature of the fires and explosions which can occur (see Annex A);

b) risks related to fires and explosions;

c) offshore environment;

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d) nature of the fluids to be handled;

e) anticipated ambient and metocean conditions, temperature, wind, wave, current, etc;

f) temperature and pressure of fluids to be handled;

g) quantities of flammable and toxic materials to be processed and stored;

h) flammability and toxicity of materials in non-hazardous areas including accommodation and control station;

i) amount, complexity, and layout of equipment on the installation;

j) location of the installation with respect to external assistance and support;

k) emergency response strategy;

l) production and staffing philosophy;

m) human factors;

n) interaction with adjacent facilities and vessels, e.g. jack-up, flotel, offtake tankers;

o) simultaneous operations e.g. drilling and production or production and construction.

5.8.2 Design loads

The evaluation of the fire and explosion hazards on the installation shall define the fire and explosion loads, which can be deterministic or risk based. The loads shall be summarized into a form to provide suitable input to the design process and thereby constitute the minimum loads that the installation shall be designed to withstand (regulatory requirements can require a higher resistance). It is often possible to provide a higher degree of resistance to fires and explosions and thus, the maximum reasonable resistance to fire and explosion shall be used in the design. The goal is to achieve a design where the risk is ALARP.

5.8.3 Fire and explosion strategy and performance standards

The results of the evaluation process and the decisions taken with respect to the need for, and role of, any risk reduction measures shall be recorded so that they are easily available for those who operate the installation and for those involved in any subsequent change to the installation.

NOTE Matters related to escape, evacuation, and rescue is covered in ISO 15544[4].

The FES does not have to be separately documented, and the relevant information may be included with other health, safety, and environmental information as part of the management of all hazardous events on an installation. For many existing installations, the FES may be contained in previous risk assessments or may be restricted to a simple statement of the standards or procedures, which are applied to deal with fire and explosion aspects of the installation.

The strategies shall be updated whenever there is a significant change in the risk picture which affects the management of the fire and explosion hazardous events.

The level of detail in a FES can vary depending on the scale and complexity of the installation and the stage in the installation life cycle when the risk management process is undertaken.

EXAMPLE 1 Complex installations, e.g. a large production platform incorporating complex facilities, drilling modules, and large accommodation modules, are likely to require detailed studies to address the fire and explosion hazardous events. Typical examples of some of the issues that can be necessary to address for such installations are given in Annex C.

EXAMPLE 2 For simpler installations, e.g. a wellhead platform or other small platforms with limited process facilities, it can be possible to rely on application of recognized codes and standards as a suitable base which reflects industry experience for this type of facility.

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EXAMPLE 3 For installations which are a repeat of earlier designs, evaluations undertaken for the original design can be reviewed to judge if they are sufficient to determine the measures needed to manage the fire and explosion hazardous events, considering new knowledge, new technology, the environment, reservoir characteristics, etc.

EXAMPLE 4 For installations in the early design phases, the evaluations will be less detailed than those undertaken during later design phases, but are often more effective at achieving lower risk solutions by implementing risk reducing measures early than in later design phases where changes are more difficult to implement.

The strategies shall describe the role and main functional requirements for each of the systems required to manage possible hazardous events on the installation. Based on the strategies, performance standards shall be developed considering the following:

a) functional parameters of the particular system, e.g. essential duties that the system is expected to perform;

b) integrity, reliability, and availability of the system;

c) survivability of the system under the emergency conditions which can be present when it is required to fulfil its role;

d) dependency on other systems or operational factors that can have an influence on the performance of the safety function when needed.

5.8.4 Verification

The performance of the critical safety systems shall be periodically verified and registered for the lifecycle of the installation to ensure that the strategies remain valid and to identify the need for any remedial action.

6 Installation layout

6.1 Objectives

The following objectives pertain to installation layout as it affects the development of fires and explosions:

— minimize the possibility of hazardous accumulations of flammable liquids and gases and to provide for the rapid removal of any accumulations which do occur;

— minimize the probability of ignition;

— minimize the spread of flammable liquids and gases which can result in a hazardous event;

— separate areas required to be non-hazardous from those designated as being hazardous;

— minimize the consequences of fire and explosions;

— provide for adequate arrangements for escape and evacuation.

6.2 Functional requirements

The layout of an installation has a major effect on the consequences of fires and explosions and on the arrangements required for EER. Consequently, for a new installation or the modification of an existing installation, the impact of layout options on the FES shall be fully evaluated as a basis for the selection of the design which, as far as reasonable, minimizes the risks of fire and explosion.

In developing the layout of the installation, consideration shall be given to maximizing, as far as reasonable, the separation by distance of the temporary refuge (TR), accommodation and escape, evacuation, and rescue (EER) facilities from areas containing equipment handling hydrocarbons.

Either separation by distance or the use of barriers (floors and walls) can prevent the escalation of fire or explosion to another area. The provision of such barriers influences ventilation, access and escape routes, ESD/EDP system design, explosion resistance, and firewater demands. The interdependency of safety

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systems shall be considered during the design of the installation. Any penetration of a barrier provided to prevent escalation of a fire or explosion shall not jeopardize the integrity of the safety function of the barrier.

Critical safety systems (such as control stations, temporary refuge, muster areas, fire water pumps, and local control panels) shall be designed, located or protected so they can perform their function under emergency conditions. This includes locating the systems where they are least likely to be affected by fires and explosions. In some situations, such systems should be designed to withstand fire and explosions and be protected from the ingress of smoke, at least until people on board have been safely evacuated or the situation has been brought under control.

The blowout preventer (BOP) diverter assemblies shall be able to perform their functions under emergency conditions. This shall include the ability to initiate and operate this equipment during these conditions. The location and operation of well kill equipment shall allow it to be used under emergency conditions.

The installation layout can result in equipment being at risk from impact of dropped objects or collisions. The need to protect critical items of process equipment, especially where failure can result in a major loss of inventory, shall be considered to determine whether impact protection is required.

7 Emergency shutdown systems and blowdown

7.1 Objective

The objective of the emergency shutdown system is to initiate appropriate shutdown, isolation, and blowdown actions to prevent escalation of abnormal conditions into a major hazardous event and to limit the extent and duration of any such events which do occur.

7.2 Functional requirements

Depending on the severity of the event and level of the alarm, an emergency shutdown (ESD) system shall be provided, in accordance with the requirements of the FES, in order to

— isolate the installation from the major hydrocarbon inventories within pipelines and reservoirs which, if released on failure, would pose an intolerable risk to personnel, environment, and the equipment,

— where appropriate, sectionalize topside inventory to limit the quantity of material released on loss of containment,

— control subsurface safety valve(s), and

— where appropriate, depressurize hydrocarbon inventory and dispose of it to a safe location.

An ESD system shall provide adequate information at the CCR so that personnel involved in managing an emergency have the information they need. The information presented to the operator and the controls provided shall be such that the operator can effectively execute the required actions in an emergency.

An ESD system shall be designed such that it can fulfil its function under the conditions which can be experienced when the system is required to operate.

If the facility is in operation, the essential shutdown functions shall be available during maintenance activities which affect the operation of the ESD system.

Emergency depressurization (EDP) systems shall be considered for pressurized hydrocarbon systems to dispose of the gaseous inventory in emergency conditions to reduce the duration of an event, the quantity of material released, or the likelihood of a pressure containing system (pressure vessels and piping) failing in a fire. Rapid depressurisation should be prioritised over passive fire protection.

ESD manual stations shall be located in strategic positions, which provide a good prospect of being able to use them in emergency conditions, be well marked, and protected against unintentional activation. Guidance on what may be considered as strategic locations is provided in B.2.

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The ESD system shall contain facilities for testing of both input/output devices and internal functions to ensure the functionality of the complete system.

8 Control of ignition

8.1 Objective

The objective of the control of ignition is to minimize the likelihood of ignition of flammable liquids and gases. Possible ignition sources are listed in A.4.

8.2 Functional requirements

Arrangements to minimize the likelihood of ignition shall be provided in accordance with the requirements of the FES. This shall include minimization of the number of potential ignition sources as far as reasonable.

The installation shall be classified into hazardous and non-hazardous areas in accordance with recognized standards or codes.

Ignition of flammable liquid and gas leaks shall be minimized, providing equipment in accordance with the area classification, disconnection of ignition source or other means for protection. The need for isolation or protection of equipment in non-hazardous areas during gas emergencies shall be considered in the FES. Isolation of EX-protected equipment should also be considered as a risk reducing measure.

Design measures or procedures to control the use of temporary equipment which can represent ignition sources shall be established.

Direct-fired equipment shall be located or protected to prevent ignition following loss of containment.

9 Control of spills

9.1 Objective

The objective of the control of spills is to provide measures for containment and proper disposal of flammable liquid spills.

9.2 Functional requirements

Arrangements for control of spills shall be provided in accordance with the requirements of the FES.

The design of the drainage system should minimise the effects of a spill and any escalation that can arise from the spill. Consider measures to minimize the risk of fires and to avoid damage to the environment. Examples of measures are drain capacity, bunding, deck coaming channels and drain fire seals.

Hazardous and non-hazardous open drains shall be physically separate without interconnection.

Hazardous closed drains shall be separate from all open drainage systems.

For floating LNG (FLNG) installations, a cold spill strategy should be developed that addresses the requirements of dedicated cryogenic drainage systems.

10 Emergency power systems

10.1 Objective

The objective of the emergency power system is to provide a reliable source of power upon loss or failure of the main power supply.

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