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Petroleum and natural gas industries — Offshore production installations — Requirements and guidelines for emergency response

Industries du pétrole et du gaz naturel — Installations de production en mer — Exigences et lignes directrices pour les réactions d'urgence

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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 15544 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, D, E, F and G of this International Standard are for information only.

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 be applied to the identification and assessment of the hazards which may be present during the various phases in the lifecycle of an offshore installation. These principles also apply to the development of the strategy, arrangements and procedures required to respond to emergencies. An understanding of the hazards can be achieved by the application of ISO 17776 [4], which gives guidelines for the processes of hazard identification and assessment for the offshore industry.

The content in this International Standard on escape, refuge, evacuation and rescue is consistent with the content of ISO 13702 [1] but addresses in more detail how these aspects are built into development of emergency response measures.

This International Standard has been prepared primarily to assist in the development of new installations, and as such it may not be appropriate to apply some of the requirements to existing installations. Retrospective application of this International Standard should only be undertaken where it is reasonable to do so. During the planning of a major change to an installation there may be more opportunity to implement the requirements, and a careful review of this International Standard should be undertaken to determine those clauses which can be utilized in the change.

This International Standard is based on an approach where the selection of measures for emergency response is determined by an evaluation of hazards on the offshore installation. The methodologies employed in this assessment and the resultant recommendations will differ depending on the complexity of the production process and facilities, type of facility (i.e. open or enclosed), manning levels, and the environmental conditions associated with the area of operation.

The verbal form “shall” indicates provisions that are mandatory and “should” indicates provisions to be considered.

Users of this International Standard should note that, while observing its requirements, they should at the same time ensure compliance with such statutory requirements, rules and regulations as may be applicable to the individual offshore installation concerned.

The principal objectives of this International Standard are to describe both the approach to be used and important considerations in determining the emergency response measures that are required on an offshore installation in order to:

— assure the safety of all personnel;

— minimize impact on the environment;

— minimize impact on assets and operations.

The technical guidance in clauses 4 to 13 of this International Standard is arranged as follows:

Objectives identify the goals to be achieved by the emergency response measures being described.

Functional requirements represent the minimum conditions which shall be satisfied to meet the stated objectives. The functional requirements are performance-orientated measures and, as such, should be applicable to the variety of offshore installations utilized for the development of hydrocarbon resources throughout the world.

Guidelines describe recognized practices which should be considered in developing the measures for emergency response. The guidelines are limited to principal elements and are intended to provide specific guidance which, due to the wide variety of offshore operating environments, may in some circumstances not be applicable.

The functional requirements and guidelines are supplemented by annexes A to H. The guidelines and annexes should be considered in conjunction with statutory requirements, industry standards and individual company philosophy, to determine the particular measures that are necessary for emergency response.

Petroleum and natural gas industries — Offshore production installations — Requirements and guidelines for emergency response

1 Scope

This International Standard describes objectives, functional requirements and guidelines for emergency response (ER) measures on installations used for the development of offshore hydrocarbon resources. It is applicable to fixed offshore structures or floating production, storage and off-take systems.

NOTE For mobile offshore units, the ER plans developed in conformance with the requirements and recommendations of the International Maritime Organization (IMO) are generally adequate for the normal, independent operation of the unit in most locations. The following aspects of ER planning are generally not addressed by IMO and should be specially considered:

— area evacuation, e.g. precautionary evacuation in areas of tropical revolving storms;

— combined operations wherein an integrated command and ER system should be developed;

— arctic operations;

— uncontrolled flow from a well.

2 Terms, definitions and abbreviated terms

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

2.1 Terms and definitions

2.1.1
abandonment
act of personnel onboard leaving an installation in an emergency

2.1.2
accommodation
place where personnel onboard sleep and spend their off-duty time

NOTE It may include dining rooms, recreation rooms, lavatories, cabins, offices, sickbay, living quarters, galley, pantries and similar permanently enclosed spaces.

2.1.3
control
<of hazards> limiting the extent and/or duration of a hazardous event to prevent escalation

2.1.4
control station
place on the installation from which personnel can monitor the status of the installation, initiate appropriate shutdown actions and undertake emergency communication

2.1.5
embarkation area
place from which personnel leave the installation during evacuation

EXAMPLES A helideck and associated waiting area or a lifeboat/liferaft boarding area.

2.1.6
emergency
hazardous event which cannot be handled by normal measures and requires immediate action to limit its extent, duration or consequences

2.1.7
emergency command centre
location from which the person in overall charge coordinates ER activities

2.1.8
emergency response
ER
action taken by personnel on or off the installation to control or mitigate a hazardous event or initiate and execute abandonment

2.1.9
emergency response arrangement
plant and equipment provided for use under emergency conditions

2.1.10
emergency response measure
anything provided to facilitate the management of an emergency

NOTE This is a generic term which includes emergency response arrangements, as well as the planning, procedural and organizational aspects of managing emergencies.

2.1.11
emergency response team
group of personnel who have designated responsibilities in an emergency for the safety of the installation, the safety of others or for environmental protection

2.1.12
emergency station
place to which emergency response personnel go to undertake their emergency duties

2.1.13
escalation
increase in the consequences of a hazardous event

2.1.14
escape
act of personnel moving away from a hazardous event to a place where its effects are reduced or removed

2.1.15
escape route
route leading to the place where people muster, or to an area from which people may leave the installation in an emergency

2.1.16
essential safety system
system which has a major role in the control and mitigation of a hazardous event and in any subsequent evacuation, escape and rescue activities

2.1.17
evacuation
planned method of leaving the installation in an emergency

2.1.18
evacuation, escape and rescue
EER
range of possible actions in an emergency

NOTE Such actions may include escape, muster, refuge, evacuation, escape to the sea and rescue/recovery.

2.1.19
evacuation, escape and rescue strategy
EERS
strategy that results from an evaluation of events that may require EER

NOTE This strategy describes the measures required and their role.

2.1.20
evacuation route
escape route which leads from the muster area to the place(s) used for primary or secondary evacuation from the installation

2.1.21
hazard
potential for human injury, damage to the environment, damage to property or a combination of these

2.1.22
hazard assessment
process whereby the results of an analysis of a hazard or hazardous event are considered against either judgement, standards, or criteria which have been developed as a basis for decision-making

2.1.23
hazardous event
incident which occurs when a hazard is realized

EXAMPLES Release of gas, fire, loss of buoyancy.

2.1.24
life-jacket
device worn by personnel which has sufficient buoyancy and stability in water to turn the body of an unconscious person and keep the person's mouth clear of the water

2.1.25
mitigation
limitation of the undesirable effects of a particular event

2.1.26
manned installation
installation which is normally occupied

2.1.27
mobile offshore unit
mobile platform, including drilling ships, equipped for drilling for subsea hydrocarbon deposits and/or for purposes other than production and storage of hydrocarbon deposits

2.1.28
muster
movement of people to a designated area so that the person in overall charge can account for all people and thereby facilitate subsequent emergency response actions

2.1.29
muster area
designated area to which personnel report when required to do so in an emergency

2.1.30
prevention
<of hazards> reduction of the likelihood of a hazardous event

2.1.31
primary method
<of evacuation> preferred method of leaving the installation in an emergency which can be carried out in a fully controlled manner under the direction of the person in charge

2.1.32
rescue
process by which those who have entered the sea directly or in survival craft/liferafts are retrieved to a place where medical assistance is available

2.1.33
risk
combination of the chance that a specified hazardous event will occur and the severity of the consequences of the event

2.1.34
secondary method
<of evacuation> method of leaving the installation in an emergency which can be carried out in a fully controlled manner under the direction of the person in charge, independent of external support

2.1.35
survival suit
protective suit made of materials which reduce body heat-loss of a person wearing it in cold water

2.1.36
survival craft
craft capable of sustaining the lives of persons in it from the time of abandoning the installation

2.1.37
temporary refuge
TR
place provided where personnel can take refuge for a predetermined period whilst investigations, emergency response and evacuation preparations are undertaken

NOTE A temporary refuge, where provided, need not necessarily be useable under all accident scenarios.

2.1.38
tertiary method
<for escape to the sea> method which relies considerably on the individual's own action

2.2 Abbreviated terms

EPIRB emergency position-indicating radio beacon

ERP emergency response plan

ERS emergency response strategy

ESD emergency shutdown

F&G fire and gas

HSE	health, safety and environmental
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
SOLAS	Safety Of Life At Sea (Conference)
TR	temporary refuge

3 Framework for emergency response

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 [2] and the principles contained therein can also be applied to issues relating to health and safety.

One key element of effective management systems is a systematic process of identification of hazards, followed by evaluation and risk management. Risk reduction is an important component of risk management, and the selection of risk reduction measures will predominantly entail the use of sound engineering judgement. However, such judgements may need to be supplemented by recognition of the particular circumstances which may require variation to past practices and previously applied codes and standards. In certain circumstances, risk assessment may be able to provide useful input to the decision-making process providing that the operator has established criteria for this purpose. Risk reduction measures should include those to prevent incidents (i.e. reducing 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. reducing the consequences). Preventative 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 the evaluation 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.

The above is general and applies to all hazards and potentially hazardous events. ER should be treated in the same manner, and ER measures should be provided based on an evaluation that takes into account possible failures of the control and mitigation measures. It is these ER measures which, as an integrated system, provide the appropriate response to an incident occurring on or near the installation.

The results of the evaluation process and the decisions taken with respect to the need for, and role of, any measures required for ER should be fully recorded, in which case the record shall be available to those who operate the installation and to those involved in any subsequent change to the installation. This record is the emergency response strategy (ERS).

ISO 13702 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 ERP should set out the operational and procedural requirements to be followed under the various emergency scenarios that are relevant for a particular installation.

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.

The resources that typically are involved in ER can be divided into three categories:

a) **unit resources**

Resources which are under the direction of the person in overall charge of the installation, and which are immediately available. They include personnel and equipment, vessels and helicopters that have been assigned ER duties.

b) **area resources**

Resources which are not under the direction of the person in overall charge of the installation, but which are located in the same area. The resources are made available by a mutual aid or cooperation agreement, and may include installations in the vicinity, supply vessels, other vessels and helicopters.

c) **external resources**

Resources which are not under the direction of the person in overall charge of the installation, and which are not located in the area. Such resources may be the organization and resources of national and international rescue services, as well as other resources which professional bodies or others may place at the disposal of the field or installation manager. This may include aircraft, helicopters, coast guard and navy vessels, shore-based personnel resources, regional or national oil pollution resources, the public health service and resources governed by international agreements and other agreements among the operators of installations.

4 Emergency response strategy (ERS)

4.1 Objectives

— To identify in broad terms the means to be used to secure an adequate ER.

— To provide a statement which will permit monitoring of the adequacy of the ER measures so that they can be modified when necessary.

4.2 Functional requirements

An ERS shall be available for all offshore installations based on an assessment of the events that can arise.

The ERS shall address the issues of organization, procedures, equipment, information, training and the role of any other measures that are necessary to achieve a successful ER.

Functional requirements for ER measures shall be set at appropriate levels, as part of the ERS, against which the adequacy of the measures can be judged.

ER measures shall be developed taking into account possible failures of the control and mitigation measures.

In developing the ERS, the reliability and availability of equipment shall be considered to determine whether additional components are required to deal with periods of non-availability, e.g. due to maintenance or breakdown.

Strategies shall be periodically reviewed to confirm that they are still appropriate, and updated whenever there is a change to the installation or external situation which may significantly affect the content of the strategy.

4.3 Guidelines

The emergency planning and the communications arrangements should be sufficiently flexible and robust to allow effective assessment of the emergency as it develops and to ensure that all personnel are informed as to the action that must be taken.

For new installations, the development of ERS and the measures required should be an integral part of the design process.

Any key assumptions used in the development of the ERS should be clearly stated, so that they can be reviewed to confirm that they are still valid.

The ERS should be periodically reviewed for adequacy by the custodian of the strategy.

ER measures to deal with acute oil pollution should be integrated into the overall ERP. The company responsible for an offshore installation should liaise with relevant authorities to develop plans to deal with any oil spills that may affect the shoreline.

When developing the ERS, the maximum number of people who might be involved in an emergency should be considered. During some phases of life cycle of an installation, such as during major construction work, the number of people on the installation can be significantly higher than assumed in the ERS. Prior to such phases of work, the impact on ER should be considered so that changes to the ER measures can be implemented before the complement increases.

Further guidance in strategies is given in annex A.

5 Emergency response plan (ERP)

5.1 Objective

— To provide a clear statement of the key ER information and the actions expected under emergency conditions.

5.2 Functional requirements

The ERP shall cover all stages of an ER, from detection of the emergency until the emergency is over and persons are considered to be in a place of safety. The ERP shall embrace all types of emergency, from minor incidents with no potential to require installation abandonment to major accidents.

The ERP shall address the operational and procedural requirements for all persons that have a role in managing an emergency, from detection of the event until the emergency is considered to be over and all people are in a place of safety.

In preparing the ERP, the various emergency scenarios requiring a response shall be considered and the appropriate organization to deal with these scenarios put in place. However, to avoid excessive detail and repetition it may be appropriate, for the purposes of planning, to group emergencies into generic types.

The ERP shall contain a clear statement of key individuals' responsibilities during emergencies.

Personnel shall be available to carry out their designated role when required to do so, or adequate alternative arrangements shall be provided.

The ERP shall address the actions required in an emergency on any other installations connected by pipelines.

The ERP shall cover other groups who are expected to provide services in the event of an emergency, but who are not themselves directly involved in the installation operations.

Those individuals or organizations who have specific actions during an emergency shall be consulted during the development of the ERP.

5.3 Guidelines

The alarm signals used on the installation and their meaning should be described in the ERP. The general procedures to be followed in the event of each alarm should also be included in the ERP.

Practices and drills should be undertaken as frequently as necessary to ensure that all personnel on the installation, whether direct employees, contractors or visitors, are aware of and fully familiar with their responsibilities under the plan.

The consequences of a loss of containment can be significantly increased if installations connected by pipelines continue to export hydrocarbons in the event of an emergency. Clear instructions should be included in the ERP on the actions to be taken on these connected installations under emergency conditions. The ERP should also detail how connected installations are alerted of the need to respond.

To ensure that there is an effective and comprehensive ERP, the following should be considered in preparing the plan:

— clearly identified responsibilities for decision-making;

— clearly identified lines of command, including how the 'on-scene' commander interfaces with area and external resources;

— competence of those with responsibility for decision-making;

— contingency arrangements to cope with key personnel being unavailable;

— effective communications to provide sufficient information for decision-making and to ensure that all personnel are adequately informed of the action they should take;

— resources available to provide assistance;

— the drills and practices required to ensure that the ERP will be effective.

In order to maintain the ERP, there should be a process to verify that:

— all the basic assumptions made in establishing the ERP are met in practice;

— people with roles in an emergency have the required competencies;

— ER equipment is being adequately maintained;

— the ER procedures are appropriate for the current understanding of the events that require ER and how they may escalate;

— area and external resources are able to perform their roles.

The ERP should be subject to the same assessment and development procedures as all other measures necessary to achieve a satisfactory ER.

Where it can be safely undertaken, consideration should be given to conducting some drills without prewarning in order to test the effectiveness of the ER procedures.

Examples of the issues that should be taken into account in drawing up the ERP are described in annex B.

6 Command and control

6.1 Objectives

— To provide a command structure which is suitable to deal with foreseeable emergencies.

— To establish the roles of any individuals or organizations that may have a role in the management of an emergency.

6.2 Functional requirements

The measures provided for command and control shall ensure that

— an effective command structure is established which is sufficiently flexible to cope with the full range of emergencies;

— the command hierarchy is clear and unambiguous and is well understood by all people on the installation;

— all personnel on the installation are adequately instructed on the appropriate action to take in an emergency;

— there is adequate redundancy such that successful ER is likely, even if key individuals are not able to perform their assigned roles;

— liaison with area and external resources can be undertaken effectively.

A command structure shall be established that will, so far as is reasonable, remain effective throughout all stages of an emergency.

6.3 Guidelines

Any emergency should have a single person accountable for the coordination of ER actions. Command and control arrangements in an emergency should be developed which take into account the normal lines of command.

For emergencies likely to be confined to the installation, the individual with responsibility for coordinating ER is likely to be the person in overall charge of the installation. For escalating emergencies, requiring assistance by area or external resources, the overall coordinator of ER is likely to be on another installation or onshore.

The command structure should be capable of functioning in different circumstances and, in particular, there should be contingency arrangements to ensure that if individuals are, or become, unavailable there will be others identified as capable of discharging the relevant responsibilities so that the ER remains effective.

The respective responsibilities between offshore and onshore support facilities, and among those on the installation, should be specified and clearly understood by all those involved. There should be adequate arrangements for hand-over of command and control functions, where necessary for different stages of the emergency.

In allocating tasks, care should be taken to avoid the assigning to an individual of multiple responsibilities that may be incompatible in an emergency.

7 Detection of the need for emergency response

7.1 Objective

— To provide arrangements and procedures that indicate the need for ER in sufficient time for the necessary actions to be successfully executed.

7.2 Functional requirements

The method and speed of response of the arrangements used to detect the need for ER shall be based on an understanding of the speed with which the incident can escalate.

All appropriate persons shall be alerted in a timely manner of the need to perform their allocated ER activities as described in the ERP.