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Guidelines for the Assessment of Reports on Major Hazards based on the requirements of Directive 2013/30/EU

Summary and highlights of the JRC training course under the Virtual Centre of Offshore Safety Expertise

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1 About the training course

Title: "Assessment of Reports on Major Hazards: A focus on the technical aspects of the assessment"

Date and Place:

The first training course was held on 13th- 14th October, 2016 at the JRC premises in Ispra, Italy.

The agenda of the training is found in Annex 1.

Material:

Guidelines for the assessment of Reports on Major Hazards

Presentations

Case studies and group exercises

Hand-outs

Training providers:

Mr. Steve Walker, former Head of the UK HSE Offshore Division

Ms. Myrto Konstantinidou, NCSR - Demokritos

Sessions of the course:

Introduction to Reports on Major Hazards

Major Hazard Identification and Risk Assessment

Equipment and Arrangements

Emergency Response

Assessment of Environmental Issues

Safety and Environmental Management Systems

Post Acceptance Issues

Training goals:

1. To introduce participants to the complexity of a Report on Major Hazards (RoMH), and to the technical, procedural, and administrative issues to be considered before and after formal acceptance;
2. To train authorities on what to look in the RoMH and how to assess the RoMH from the technical point of view;
3. To illustrate all the above in a series of practical and hands-on sessions, using case studies based on real RoMHs.
4. To provide practical "tips" based on best practices of RoMH assessment;
5. To allow exchange of views on the various approaches taken, difficulties encountered, lessons learned, and final conclusions drawn by the participants during the exercises.

Audience:

The members of the EU Offshore Authorities Group (EUOAG).

All interested personnel responsible for assessing Reports on Major Hazards under Directive 2013/30/EU, in all MS Competent Authorities.

Outcomes:

The training course introduced Competent Authorities to the challenges of assessing a RoMH, and provided training on what to look for and how to perform the assessment from the technical point of view.

Abbreviations

ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
BOP	Blow Out Preventer
CA	Competent Authority
CMAPP	Corporate Major Accident Prevention Policy
DG ENERGY	The Directorate-General for Energy
E&P	Exploration & Production
EER	Emergency Evacuation and Response
EIA	Environmental Impact Assessment
EMSA	European Maritime Safety Agency
ERP	Emergency Response Plan
ERRV	Emergency Response and Rescue Vessel
ESIA	Environmental & Social Impact Assessment
EUOAG	European Union Offshore Authorities Group
F&E	Fire & Explosion
FMEA	Failure Mode and Effects Analysis
JRC	Joint Research Centre
FPSO	Floating Production Storage and Offloading unit
HAZID	Hazard Identification study
HAZOP	Hazard and Operability study
HSE UK	Health Safety Executive UK
HSEQ	Health Safety Environment and Quality
HVAC	Heating, ventilation and air conditioning
IADC	International Association of Drilling Contractors
IERP	Internal Emergency Response Plan
IMO	International Maritime Organization
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Organization for Standardization
IT	Information Technology
LWC	Loss of Well Control
MH	Major Hazard
MS	Member State (EU)
MLD	Master Logic Diagram
MODU	Mobile Offshore Drilling Unit
O&G UK	Oil & Gas UK
OGP (now IOGP)	International Association of Oil and Gas Producers
OHSAS	Occupational Health and Safety Assessment Series
OREDA	Offshore and Onshore Reliability Data (project)
OSD	Offshore Safety Directive (Directive 2013/30/EU)
OSRL	Oil Spill Response Ltd.
PHA	Process Hazard Analysis
PID	Piping & Instrumentation Diagram
PPE	Personal Protective Equipment
QRA	Quantitative Risk Assessment
REMPEC	Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea
RoMH	Report on Major Hazards
RP	Recommended Practice
SECE	Safety and Environmental Critical Element
SEMS	Safety and Environmental Management System
SHIDAC	Structured Hazard Identification and Control process
SOLAS	International Convention for the Safety of Life at Sea
TEMPSC	Totally Enclosed Motor Propelled Survival Craft
TR	Temporary Refuge
ViCOS	Virtual Centre of Offshore Safety Expertise
WOAD	Worldwide Offshore Accident Databank

Definitions

Blowout	An uncontrolled flow of well fluids and/or formation fluids from the wellbore to surface or into lower pressured subsurface zones (underground blowout). Source: *Guidance Document on Commission Implementing Regulation (EU) No1112/2014 of 13 October 2014* (available at: http://euoag.jrc.ec.europa.eu/files/attachments/2015_11_25_implementing_regulation_guidance_document_final.pdf)
Competent Authority	Public authority, appointed pursuant Directive 2013/30/EU and responsible for the duties assigned to it in this Directive. The competent authority may be comprised of one or more public bodies [*Article 2(14) Directive 2013/30/EU*]
Independent Verification	An assessment and confirmation of the validity of particular written statements by an entity or an organisational part of the operator or the owner that is not under the control of or influenced by, the entity or the organisational part using those statements [*Article 2(29) Directive 2013/30/EU*]
Installation	A stationary, fixed or mobile facility, or a combination of facilities permanently inter-connected by bridges or other structures, used for offshore oil and gas operations or in connection with such operations. Installations include mobile offshore drilling units only when they are stationed in offshore waters for drilling, production or other activities associated with offshore oil and gas operations [*Article 2(19) Directive 2013/30/EU*]
Oil Spill	An oil spill is oil, discharged accidentally or intentionally, that floats on the surface of water bodies as a discrete mass and is carried by the wind, currents and tides. Oil spills can be partially controlled by chemical dispersion, combustion, mechanical containment and adsorption. Source: *OECD glossary* (https://stats.oecd.org/glossary/detail.asp?ID=1902)
Operator	Entity appointed by the licensee or licensing authority to conduct offshore oil and gas operations, including planning and executing a well operation or managing and controlling the functions of a production installation *[Article 2(5) Directive 2013/30/EU]*
Owner	'owner' means an entity legally entitled to control the operation of a non-production installation [*Article 2(27) Directive 2013/30/EU]*
Loss of well control	Uncontrolled flow of subterranean formation fluids such as gas, oil, water, etc. and/or well fluids into the environment or into a separate underground formation, in which case it is called an underground blowout. Source: *API STD 65 – Part 2, Isolating Potential Flow Zones During Well Construction, Upstream Segment, Second Edition, December 201*0. Other definitions at: http://www.iadclexicon.org/loss-of-well-control-lwc/
Report on Major Hazards	A document prepared by the operator or owner of an installation and submitted to the Competent Authority of the relevant Member State to demonstrate that all major accident hazards have been identified, and that suitable control measures have been put in place in order to reduce the risk of a major accident to an acceptable level. [*Directive 2013/30/EU*]

2 Introduction

The blowout on the Deepwater Horizon drilling rig on April 20th 2010, whilst drilling the Macondo well in the Gulf of Mexico, significantly raised worldwide awareness of the risks involved in offshore oil and gas operations. In addition to the tragic loss of eleven lives, the blowout released nearly five million barrels of oil into the waters of the Gulf, and is considered to be the world's largest accidental oil spill from offshore operations.

In order to ensure a high level of safety in the European offshore oil and gas industry, the EU Parliament and the Council published Directive 2013/30/EU, amending Directive 2004/35, obliging national Competent Authorities to control safety aspects of the offshore oil and gas installations in their waters. One of the fundamental new requirements of Directive 2013/30/EU is the preparation and submission by owners and operators of a **Report on Major Hazards** (RoMH) for every offshore installation. The RoMH aims at providing evidence that the overall risks from the installation (both to operators and to the environment) have been reduced to an acceptable level.

Offshore oil and gas operations can only be conducted by that installation if its RoMH has been assessed and accepted by the Competent Authority of the relevant Member State.

A Competent Authority (CA) - appointed pursuant to Directive 2013/30/EU - should be legally empowered and capable of performing the assessment of the relevant RoMHs. In order to assist CAs to acquire these competencies, the European Commission's Directorate-General for Energy (DG ENER) appointed the Joint Research Centre (JRC) for the development of a ***Virtual Centre of Offshore Safety Expertise (ViCOS)***.

ViCOS is intended to be the meeting point for Competent Authorities, third-party offshore experts and other stakeholders. Among its various services, ViCOS is also a centralised training facility with workshops and training delivery programs for regulatory and technical experts.

Discussions with Member States' representatives at the European Union Offshore Competent Authorities Group (EUOAG) have identified that Competent Authority training in the assessment of RoMHs and linked documentation is one of the main priorities, especially for those Member States who did not currently have a mature offshore industry in their waters.

The present ***Guidelines for the Assessment of Reports on Major Hazards (as required by Directive 2013/30/EU)*** have been prepared as a summary of the first training course organised under ViCOS, held at the premises of the JRC Ispra in October 2016. These guidelines are structured in the following sections:

- A Framework for RoMH assessment;
- Major Hazard Identification and Risk Assessment;
- Safety & Environmental Management Systems (SEMS);
- Equipment and Arrangements;
- Emergency Response – Safety Aspects;
- Emergency Response – Environmental Aspects;
- Independent Verification;
- Post Acceptance Issues.

3 Training providers and authors of the Guidelines

Steve Walker - Author of the guidelines and main provider of the training course.
Former Head of the UK HSE Offshore Division and former co-chair of the EUOAG.

After obtaining a degree in Chemical Engineering and working in industry, Steve worked for the UK Health and Safety Executive (HSE) for 38 years. During that time, Steve worked as a health & safety regulator in a wide number of operational posts (covering major hazard industries, such as chemical plants, the offshore industry, and railways), providing proactive inspections/audit, accident investigations and enforcement activity.

After 5 years as an Operations Manager in HSE's Offshore Division (OSD), he became Head of OSD from 2009-2013, responsible for the Division which assessed and regulated the integrity and safety of the approximately 300 offshore oil & gas installations on the United Kingdom Continental Shelf. Following an HSE re-organisation in April 2013, Steve became the Head of Strategic Intervention for the new Energy Division (ED). He had particular responsibilities for developing the UK/HSE implementation of the Offshore Safety Directive 2013/30/EU.

From 2012-2014, Steve was the chair of the North Sea Offshore Authorities Forum (NSOAF) and the inaugural co-chair of the European Union Offshore Authorities Group (EUOAG).

Steve retired from HSE in April 2014 and undertakes ad-hoc consultancy work. He is currently an Associate of HSL on infrastructure ageing and life extension, most recently within the nuclear chemicals industry. He has undertaken independent expert work relating to offshore contractual litigation, and has worked on behalf of the European Commission and the US Chemical Safety Board on offshore oil & gas regulatory issues. He has also advised the Constructing Better Health (CBH) organisation in relation to offshore occupational health matters.

Steve was made a Chartered Fellow of IOSH in September 2014.

Myrto Konstantinidou - Co-author of the guidelines and contributor to the training course.
Research Scientist at Systems Reliability and Industrial Safety Laboratory - NCSR Demokritos.

Myrto has more than 15 years' experience in Quantified Risk Assessment of industrial installations and Accident analysis. Her main focus of research has been on the causes of Industrial Accidents in the Oil and Gas sector (including offshore) as well as on the integration of Human Factors in the risk assessment, safety management and investigation of major accidents.

Her current position is in Systems Reliability and Industrial Safety Laboratory of the National Centre of Scientific Research in Greece where she is involved in developing methodologies for Quantified Risk Assessment in various sectors. She has provided scientific support to the European Directive 2013/30/EU on "Safety of offshore oil and gas prospection, exploration and production activities" and participated to the development of the pilot version of the Virtual Centre of Offshore Safety Expertise. She has proven experience in the implementation of SEVESO Directive in Greece (including assessment of Major Hazards reports, safety audits and investigations). She is also familiar with regulatory practices in different EU countries for safety and environmental issues. She has participated in numerous European and national projects, coordination actions and networks for the improvement of industrial safety.

4 A Framework for RoMH Assessment

- ✓ 4.1 Types of RoMHs
- ✓ 4.2 What should a RoMH contain and cover?
- ✓ 4.3 Assessment and acceptance of RoMH by the CA

Key Message:
"No accepted RoMH – No commencement of operations"

4.1 Types of RoMHs

A **Report on Major Hazards** (RoMH) is a document that shall be prepared by the operator or owner of an installation and submitted to the Competent Authority (CA) to demonstrate that all major accident hazards have been identified, and that adequate control measures have been put in place in order to reduce the risk of a major accident to an acceptable level [*Articles 12 and 13*[1]].

Article 12 (1) - Directive 2013/30/EU
Member States shall ensure that the operator prepares a report on major hazards for a production installation, to be submitted pursuant to point (e) of Article 11(1). That report shall contain the information specified in Annex I, Parts 2 and 5 and shall be updated whenever appropriate or when so required by the competent authority.

Article 13 (1) - Directive 2013/30/EU
Member States shall ensure that the owner prepares a report on major hazards for a non-production installation, to be submitted pursuant to point (e) of Article 11(1). That report shall contain the information specified in Annex I, Parts 3 and 5 and shall be updated whenever appropriate or when so required by the competent authority.

Directive 2013/30/EU (otherwise known as *Offshore Safety Directive*, OSD) anticipates two broad categories of RoMHs for offshore oil and gas installations:

- **Production Installation RoMHs**, which include those for fixed installations (i.e. with foundations on the sea bed) and those for floating installations, such as FPSOs (Floating Production, Storage and Offloading);
- **Non-production Installations RoMHs**, which include those for Mobile Offshore Drilling Units (MODUs) and Flotels.

Articles 2 (16), (20) - Directive 2013/30/EU
A production installation is an installation used for production, i.e. offshore extraction of oil and gas from the underground strata of the licensed area, including offshore processing of oil and gas and its conveyance through connected infrastructure.

Article 2(17) - Directive 2013/30/EU
A non-production installation is an installation other than an installation used for production of oil and gas.

Example. Entities responsible for the submission of RoMHs:
- *In the case of the Deepwater Horizon drilling rig, the relevant RoMH would have been provided by Transocean (as the drilling contractor - owner or the rig), rather than the operator BP.*

Upon receipt of the RoMH, the Competent Authority must ensure that operations are not commenced **until the RoMH is assessed and accepted**:

- The Directive requires that operations relating to Production and Non-Production Installations are not to commence until the RoMH has been accepted by the relevant Member State Competent Authority (CA) [*Article 6(5)*].

[1] All Articles mentioned in the present document refer to Directive 2013/30/EU.

Note. No exemptions for a short-term activity are allowed by the OSD: even one-day operations of an installation require the formal acceptance of a RoMH.

- Where material changes to the installations are subsequently made, changes should not be brought into use or operations commenced until the CA has accepted the amended RoMH [*Articles 12(6), 13(6)];*
- Where the dismantlement of a fixed production installation is proposed, any dismantling should not commence until the CA has accepted the amended RoMH [*Article 12(6)*].

> ***Article 12 (6) - Directive 2013/30/EU***
> *Member States shall ensure that the planned modifications are not brought into use nor any dismantlement commenced until the competent authority has accepted the amended report on major hazards for the production installation.*
>
> ***Article 13 (6) - Directive 2013/30/EU***
> *For a mobile non-production installation, Member States shall ensure that the planned modifications are not brought into use until the competent authority has accepted the amended report on major hazards for the mobile non-production installation.*

There are a number of related notifications which also have to be submitted to the CA during the life cycle of a particular offshore installation. These notifications are strongly linked to the relevant RoMHs for the installation considered, i.e.:

- A **design notification** [*Article 11(3)*] for a planned production installation is required **to be submitted prior to the submission of the initial RoMH**, by a deadline set by the CA. The CA is required to "respond" to such a notification, with comments which should be taken into account within the subsequent RoMH for the production installation.

> ***Example.*** A design notification is required at a very early stage in the installation's lifecycle, i.e. before a planned production installation is about to be constructed and subsequently put into operation for the first time in MS waters. The MS CA should be notified of the installation's basic design details in advance, and should respond with some comments. The operator is not obliged to accept CA comments, but must be able to explain how those comments would be taken into account in the subsequent RoMH.

- A **relocation notification** [*Article 11(5)*] is required when an existing production installation is to be moved to a new production location. The deadline for such a notification is set by the CA who, once again, is required to "respond". The CA comments have to be taken into account within the subsequent RoMH for the production installation at the new location.

> ***Article 11 (5)***
> *The relocation notification required pursuant to point (j) of paragraph 1 shall be submitted to the competent authority at a stage that is sufficiently early in the proposed development to enable the operator to take into account any matters raised by the competent authority during the preparation of the report on major hazards.*
>
> ***Article 11 (1)***
> ***(j)*** *in the case of an existing production installation which is to be moved to a new production location where it is to be operated, a relocation notification in accordance with Annex I, Part 1.*

> ***Example.*** A relocation notification is required when an FPSO is going to be moved to a new field within MS waters.

Note. A relocation notification is only applicable to floating production installations. A design notification is applicable to fixed and floating production installations that will be constructed and eventually put into operation for the first time.

- A **Well Operations Notification** [*Article 15*] is required to be submitted to a deadline set by the CA when a well operation is to be carried out. The CA is required to "consider" this notification and take appropriate action "if necessary".
  In particular, a Well Operations Notification shall be submitted to the CA together with or after the submission of the relevant RoMH, and prior to the commencement of well operations.

> ***Article 15 (1)***
> *Member States shall ensure that the operator of a well prepares the notification to be submitted pursuant to point (h) of Article 11(1) to the competent authority. It shall be submitted by a deadline set by the competent authority that is before the commencement of the well operation. That notification of well operations shall contain details of the design of the well and the proposed well operations in accordance with Annex I, Part 4. This shall include an analysis of the oil spill response effectiveness.*

> ***Example #1.*** Well operations notifications will inevitably be required when a drilling rig (e.g. MODU) is going to operate in Member States' waters. In that case, a RoMH for a non-production installation will first be needed. If the MODU already operates in MS waters with an accepted RoMH and is going to be moved to a new field within the same MS waters, then a new RoMH for the above-mentioned rig is not required but new well operations notifications will be required for the work at the new location. The well operator is responsible for the preparation and submission of well operations notifications.
>
> ***Example #2.*** A well operations notification is required before any entry to an existing (operational) well that can lead to the release of hydrocarbons and potential major hazard.

More details about Well Operations Notifications are given in Chapter 11 (*Post Acceptance Issues)*.

- A **Combined Operation Notification** [*Article 16*] is required to be submitted to a deadline set by the CA when a combined operation involving two or more installations is to be carried out. Similarly to the notification for well operations, the CA must "consider" it, and take appropriate action "if necessary".

> ***Article 16 (1)***
> *Member States shall ensure that operators and owners involved in a combined operation jointly prepare the notification to be submitted pursuant to point (i) of Article 11(1). The notification shall contain the information specified in Annex I, Part 7. Member States shall ensure that one of the operators concerned submits the notification of combined operations to the competent authority. The notification shall be submitted by a deadline set by the competent authority before combined operations are commenced.*

> ***Example.*** A combined operations notification shall be submitted to the CA when a mobile drilling unit comes alongside a fixed production platform in order to re-enter the well, or when any other installation, such as a flotel, is going to perform a joint operation with another installation.

- A **Notification of Entering or Leaving** a Member State's Waters [*Article 11(4)*], is required when an existing production installation is due to enter or leave the waters of a Member State. The relevant CA should be notified prior to that date, though just for informational purposes. There is no requirement for the CA to respond to such a notification.

> ***Article 11 (4)***
> *Where an existing production installation is to enter, or leave the offshore waters of a Member State, the operator shall notify the competent authority in writing prior to the date on which the production installation is due to enter or leave the offshore waters of the Member State.*

> ***Example.*** When an FPSO starts its preparation to enter MS waters, the competent authority of that MS should receive a written notification to this purpose.

More information on other relevant documentation is found in Chapter 11 (*Post Acceptance Issues*).

However, to add to this complexity of submissions and notifications, Member States' CAs (depending on their own scope of activities) may also be involved with responsibilities for offshore installations (including formal submissions and notifications) under other linked EU Directives. These include:

- offshore licensing and authorisation under Directive 94/22/EC;
- issues of relating to environmental liability under Directive 2004/35/EC and its amending Directive 2014/52/EU;
- safety of workers under Directive 92/91/EEC.

The involvement of competent authorities during the life cycle of offshore installations is illustrated in Figure 4.1.

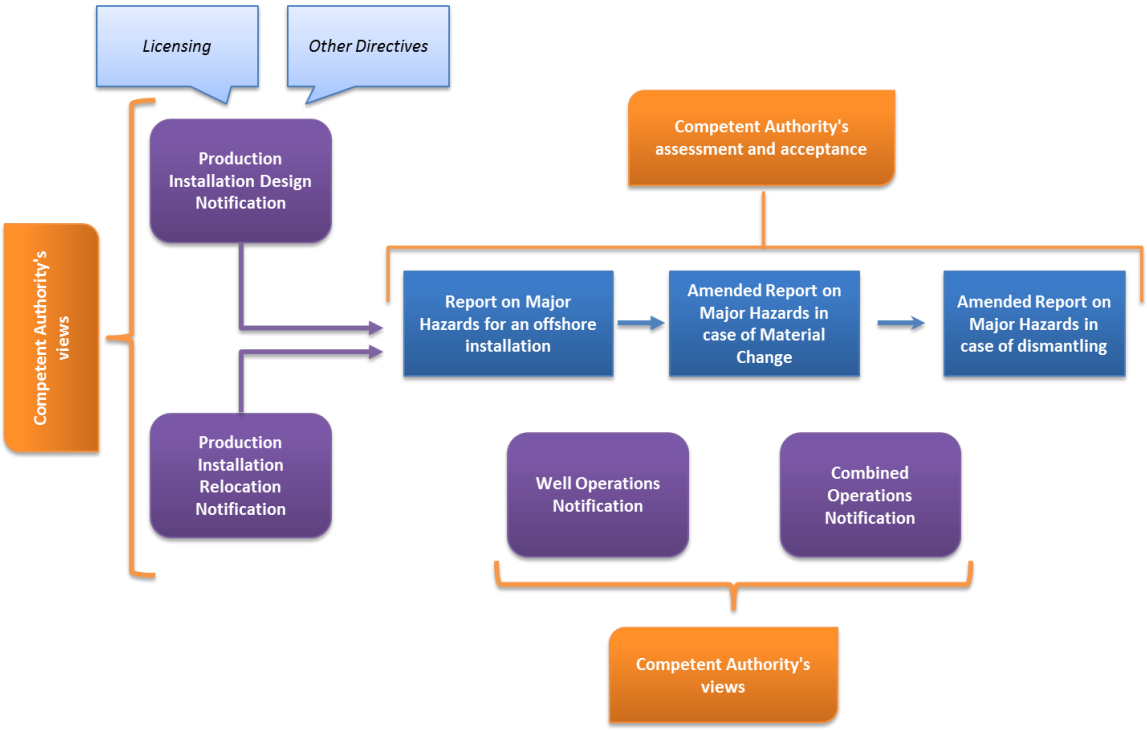


Figure 4 1 Life Cycle of Competent Authority involvement with RoMHs and offshore notifications

4.2 What should a RoMH contain and cover?

The RoMH requirements within the Directive are sometimes confusing and complex. Particular attention should be given to the Directive's definition of "major accident" [*Article 2(1)*]. The scope of the Directive (and thus of the RoMHs) is to focus on the regulation of those events with the potential for multiple fatalities and/or for significant environmental damage.

> ***Article 2 – Definition of "Major Accident"***
> *A 'major accident' means, in relation to an installation or connected infrastructure:*
>
> a) an incident involving an explosion, fire, loss of well control, or release of oil, gas or dangerous substances involving, or with a significant potential to cause, fatalities or serious personal injury;
> b) an incident leading to serious damage to the installation or connected infrastructure involving, or with a significant potential to cause, fatalities or serious personal injury;
> c) any other incident leading to fatalities or serious injury to five or more persons who are on the offshore installation where the source of danger occurs or who are engaged in an offshore oil and gas operation in connection with the installation or connected infrastructure; or
> d) any major environmental incident resulting from incidents referred to in points (a), (b) and (c).

Although the Directive makes a distinction between RoMHs for Production and for Non-Production installations, these two types of RoMHs follow the same pattern of requirements, with both types of RoMHs required to contain information in four broad categories, as shown in Figure 4.2.

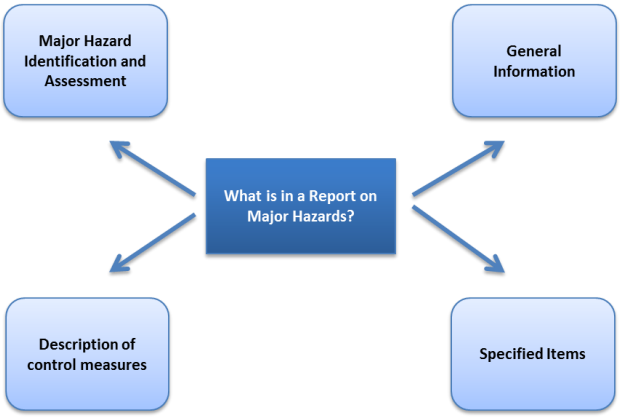


Figure 4 2 Contents of a Report on Major Hazards

Within these four broad categories – which can be thought of as "*Chapters*" – RoMHs are required to contain the following:

A. General Information;
B. Major Hazard identification and assessment;
C. Description of Control Measures;
D. Specified Items.

The specific content of each of the aforementioned categories is detailed below.

A. General Information

- Name and address of operator or owner;
- Maximum number of persons on installation;
- Description of the installation, including any connected infrastructure;
- For mobile non-production installations, description of means of transfer and stationing;

- Summary of workers' involvement in the preparation of the RoMH;
- Relevant codes, standards and guidance used in construction and commissioning.

B. Major Hazard identification and assessment

- Demonstration that all Major Hazards (MHs) have been identified;
- Demonstration that the MH likelihood and consequences have been assessed;
- Description of types of operations with that MH potential;
- Demonstration that the control measures – including Safety and Environmental Critical Elements (SECEs) – are suitable to reduce risks to an acceptable level. This also includes an assessment of oil spill response effectiveness.

C. Description of control measures

- Description of equipment and arrangements to ensure:
  - Well control;
  - Process Safety and prevention of fire/explosion;
  - Containment of, and worker protection from, hazardous substances;
  - Protection of environment from major accidents;
- Description of arrangements to protect persons, including:
  - Escape, evacuation and rescue;
  - Maintenance of control systems if everyone is evacuated;
- Adequate description of the relevant Safety and Environmental Management System (SEMS).

D. Specified items

- Description of the Independent Verification Scheme;
- Description of the Internal Emergency Response Plan;
- Information relevant to other specified Directives, including:
  - Directive 92/91/EEC (safety and health protection of workers in the mineral-extracting industries through drilling);
  - Directive 2011/92/EU (assessment of the effects of certain public and private projects on the environment);
- Assessment of environmental effects from loss of containment, including a description of the technical and non-technical measures envisaged to prevent, reduce or offset those effects, including monitoring.

4.3 Assessment and acceptance of RoMH by the CA

Competent Authorities have the crucial function of assessing and accepting RoMHs. According to the OSD [*Article 2(22)*], by accepting a RoMH, the CA confirms that the document meets the requirements of the Directive.

> ***Article 2 (22)***
> *'acceptance', in relation to the report on major hazards, means the communication in writing by the competent authority to the operator or the owner that the report, if implemented as set out therein, meets the requirements of this Directive. Acceptance does not imply any transfer of responsibility for control of major hazards to the competent authority.*

This will be a high-profile activity for the CA, with the potential for significant external pressure from the owner/operator to accept the RoMH as soon as possible and - if possible - without major changes, with

diverse views from public pressure groups either to reject the RoMH (e.g. from environmental groups) or to accept it (e.g. from industry and employee bodies), and possibly conflicting views within the respective Government Ministries.

Guidance on the aspects that CAs should look at when performing a "*thorough assessment*" are listed in the Directive's *Annex III (2) (3)*, and this should form a key part of the formal assessment procedures for any CA. In summary, Annex III (2)(3) requires that - when assessing a RoMH - the CA ensures that:

- All required factual information is provided;
- All reasonably foreseeable major accident hazards and their initiating events are identified (with clear methodology);
- Risk management takes into account the life cycle of the installation;
- It is clear how the proposed measures reduce risk to an acceptable level;
- Whether good practise, sound engineering principles, human and organisational factors have been taken into account;
- Response to emergencies:
  - arrangements to detect and rapidly respond are clearly identified and justified;
  - arrangements for escape, evacuation and rescue are integrated and systematic;
  - requirements are incorporated into the internal emergency response plans;
- The independent verification scheme is clearly explained;
- The Safety & Environmental Management System (SEMS) is adequate, including auditing and implementation of audit recommendations.

The way any CA organises itself to assess and accept RoMHs will depend upon a number of factors, i.e.:

- whether the CA is a single or joint authority;
- the scope and style of the MS's implementing legislation;
- the involvement of any non-CA specialists within the assessment team;
- the involvement of the CA in any licensing or economic development activities.

However, Directive 2013/30/EU requires CAs to establish transparent policies, processes and procedures for assessing RoMHs. Unfortunately, the specific requirements of the Directive do not lend themselves to the creation of a standard layout for a RoMH, and this has implications when CAs decide on the process they need to adopt to undertake a rigorous RoMH assessment.

Some practical advice for CAs when undertaking RoMH assessment, based on experience, is the following:

- **Operator responsibility**: the onus is on the operator or owner to convince the CA that their RoMH is suitable, not the other way around.
- **Iterative process**: expect an iterative process, with requests from the CA for more data, clearer explanations etc. Some common, generic issues from RoMH assessment are described in more detail in SEMS section.
- **Correlation with the Directive**: RoMHs can be long, detailed and complex documents, and not written with the framework of the Directive in mind. With this is mind, it can be very time consuming for the CA to have to search for where specific requirements of the Directive are covered, so get operator/owner to identify which part of RoMH covers which requirement from the Directive.
- **Check list**: upon receipt of a RoMH for the first time it is important to have an initial scrutiny process to check that all the necessary information is in the RoMH, and send it back if

something is missed. A checklist on the content of a Report on Major Hazards, which can be used for such initial completeness scrutiny, is proposed in Annex 2.

- **Paper version**: consider the benefits of paper rather than electronic versions of some parts of the RoMH, such as process flow diagrams and PIDs.
- **Prior items**: it will not be necessary to consider every item within a RoMH to the same level. Some issues will require assessment at a greater depth than others.
- **Project management principles**: use project management principles, with clear project leadership and governance, adequate attention to team "design", roles and resources, and clear decision making and recording procedures.
- **Agreed and documented processes** are important when more than one body is involved within the CA assessment team. As part of these, consider the IT requirements at an early stage, including design of templates & control of documentation.
- **Action tracking**: establish good progress monitoring, progress and actions tracking with the assessment depends on the slowest member of the team.
- **Early discussion**: have early internal discussions within the team to establish consistency of assessment approaches and decision making.
- **Collaboration with Operator**: establish good and consistent communication between CA and owner/operator. Regular face-to-face progress meetings with external parties can avoid "death by email", and make CA arrangements very clear to distinguish asking for more information to clarify issues from raising matters of significant concern which could, if not addressed, jeopardise acceptance.
- **Transparency**: remember that the whole RoMH assessment/acceptance process will be undertaken within expectations of transparency of decision making. Therefore, CAs must ensure that they have adequate (and documented) disputes resolution processes, peer review arrangements, and appeal procedures as part of their overall RoMH assessment process.

SUGGESTIONS

Use project management principles:

- Clear project leadership and governance
- Team "design" and roles
- Resources management
- IT issues – including templates & control of documentation
- Agreed, documented processes (especially important when more than one body is involved)
- Clear allocation of work to project team members
- Clear decision making and recording procedures
- Consistent communication arrangements between CA and owner/operator
- Peer review, disputes and appeal arrangements

Key Message:
The engagement with the operator or owner at the early stage of RoMH lifecycle is an important aspect, and CAs are encouraged to:

1. *Meet with the operator/owner prior to the RoMH submission, in order to clearly explain what is expected from the RoMH;*
2. *After submission of the RoMH, ask operators/owners to demonstrate where each section of the Directive requirements is situated inside the RoMH;*
3. *Look through the RoMH to analyse whether each section (e.g. SEMS, Environment, Equipment) requires additional expertise or not.*

Key Message:
*The CA should keep the **right balance between cooperation and independence/objectivity** towards the operator/owner while assessing a RoMH.*

Approach to RoMH assessment

In assessing many of the Directive's specific RoMH requirements, CAs have the option of adopting a "vertical slice" or a "horizontal slice" assessment approach. In a vertical slice approach, each of the various specific RoMH requirements (SEMS, Risk Assessment, Verification, Emergency Response etc.) are individually assessed in their totality.

For instance, when assessing the SEMS, the relevant assessment team member would look at both the overall structure of the SEMS, and also the adequacy of how each of its components - competency, supervision, auditing etc. - are applied across the installation's activities. In a horizontal approach, though, assessment team members would instead look across each of the specific RoMH requirements from a particular topic specialist perspective. Thus, one assessor would have a "well control" remit, and would look at the adequacy of how all the common requirements – SEMS, Risk Assessment, Emergency Response, etc. – apply to well control matters. Other assessment team members would adopt a similar approach, each with having specific remits for, say, Fire & Explosion, Control & Instrumentation, Environmental Protection etc.

The assessment approach which each CA adopts will need to reflect the size and competencies of their particular CA assessment resource. Actually, a mixture of both the vertical and horizontal slice approaches is often preferable – using the SEMS requirements as an example, one assessor could have the role of assessing the suitability of the overall SEMS structure, policies, and arrangements. If the overall SEMS was considered adequate, other assessors could then provide additional assurance by looking how that overall SEMS structure is implemented within particular specialist topics – e.g. competency arrangements for Well Control/Drilling, verification with respect to Fire & Explosion control, and monitoring within the Environmental Protection field. Figure 3 below gives a schematic for a possible Competent Authority RoMH assessment/acceptance process. In this case, a vertical slice approach has been adopted, but the scheme can simply be amended to a horizontal slice approach, or even a mixture of the two.

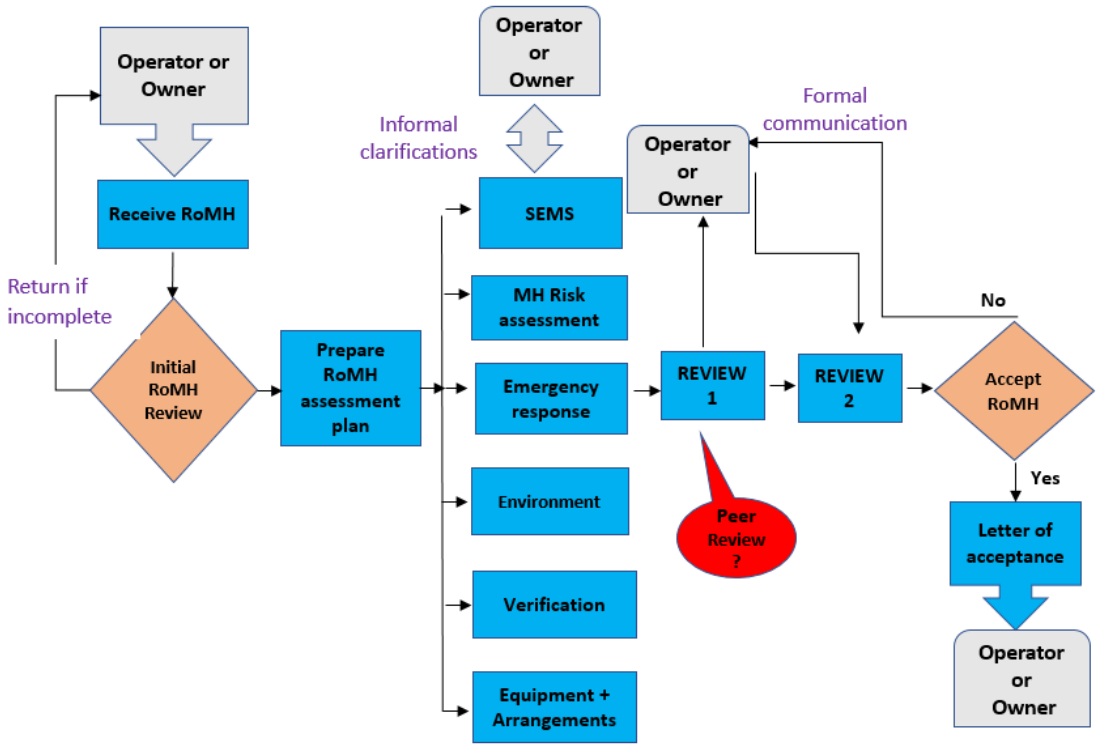


Figure 4 3 RoMH assessment and acceptance approach by CAs

Exercise:

A. You have just received a RoMH for a mobile drilling rig to come into your waters to drill a series of exploratory wells. Please, identify and list (a) four external pressures and (b) four internal pressures on you as a competent authority in assessing and accepting the RoMH.

B. Consider what you, as competent authorities, need to do to address each of those pressures.

Exercise Conclusion:

Typical external pressures:

- From the installation operator/owner to accept the RoMH (or associated notifications) as soon as possible, and without major changes;
- Possible similar pressure to accept RoMH quickly from Energy or Revenue Ministers;
- Pressure from Environmental/Safety Ministers to do an exemplary job;
- Public will be vocal, with environmental interests demanding CAs not to accept (and challenging if they do), but others urging acceptance.

How to address external pressures:

- Communication with all stakeholders, looking for mutual agreements;
- Transparent approach: sharing of procedures, engagement into discussion, etc.
- Set up clear expectations for RoMH contents with the operator/owner.

Typical internal pressures:

- Considerable detailed documentation to consider;
- RoMH assessment process can be complex to manage;
- Time pressure to get assessment completed;
- Lack of experience within the CA;
- Having to deal with industry "offshore specialists"
- "Acceptance" is different from usual regulation activities;
- Expectations that work can be done by those with existing responsibilities;
- Lack of available resources – especially technical expertise;
- High profile work because of political, press and pressure group interest.

How to address internal pressures:

- Take all the time needed to make a thorough assessment, however fix the necessary deadlines;
- Set up clear internal guidelines, including: procedures, timeframes, additional expertise needed, etc.
- Consider a visual inspection of the installation in addition to the assessment of the RoMH documentation.

5 Major Hazard Identification and Risk Assessment

- ✓ 5.1 Risk evaluation methodology
- ✓ 5.2 Case Study

In any major hazard industry, if the identification of the key major hazard risks is flawed, and the assessment of those risks inconsistent, then subsequent decisions on the adequacy of control measures and other safety and environmental arrangements will inevitably be inadequate. Therefore, the Major Hazard identification and risk assessment processes within any offshore RoMH is of crucial importance, and the requirements in ***Annex I of Directive 2013/30/EU*** reflect this, i.e. by requiring RoMHs (for both Production and Non-Production installations) to contain:

- A demonstration that all the major hazards have been identified, their likelihood and consequences assessed, including any environmental, meteorological and seabed limitations on safe operations, and that their control measures including associated safety and environmental critical elements are suitable so as to reduce the risk of a major accident to an acceptable level [*Parts 2(5) and 3(5)*];
- any other relevant details, for example where two or more installations operate in combination in a way which affects the major hazard potential of either or all installations [*Parts 2(13) and 3(14)*];

In addition:

- **Production installation** RoMHs should include "a description of the types of operations with major hazard potential to be carried out […]" [*Part 2(6)*];
- **Non-Production installations** RoMHs should include a "demonstration that all the major hazards have been identified for all operations the installation is capable of performing, and that the risk of a major accident is reduced to an acceptable level [*Part 3(9)*]."

According to the above requirements during the assessment of RoMHs a CA has to ensure that:

- All required factual information is provided by the operator or owner;
- All reasonably foreseeable major accident hazards and their initiating events are identified through a clear methodology risk management process takes into account the whole life cycle of the installation having anticipated all foreseeable situations including:
  - the design decisions in the design notification to ensure inherent safety and environmental principles;
  - well operations to be conducted from the installation when operating;
  - well operations to be undertaken and temporarily suspended before production is commenced;
  - combined operations to be undertaken with other installation;
  - how the decommissioning of the installation will be undertaken;
- A justification on how the proposed/taken measures reduce the risk of the installation to an acceptable level;
- Whether good practise, sound engineering practise and human and organisational factors have been taken into account during the whole process.

5.1 Risk evaluation methodology

The typical steps to be followed in an overall risk evaluation methodology are depicted in Figure 5.1. These include hazard identification and the subsequent accident sequence analysis, which is fundamental for proper frequency assessment and the consequence estimation.

All of these steps are required to calculate risk as a function of the probability of occurrence of an event and its associated potential consequences. Risk is usually represented by use of risk matrices or iso-risk curves.

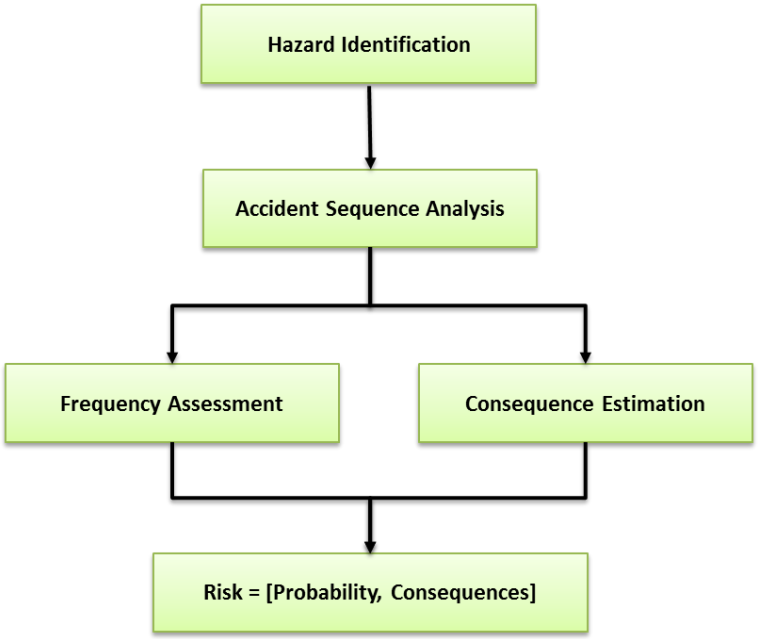


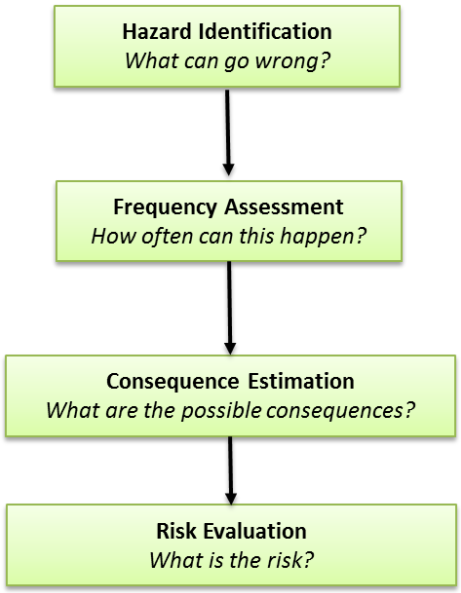
Figure 5 1 Main steps in risk evaluation methodology

Directive 2013/30/EU does not prescribe any specific risk identification/assessment methodology to be used in the RoMH.

For Production installations, ISO Standard 17776[2] provides some offshore industry specific guidelines. For Non-Production installations, some guidance can be found in the International Association of Drilling Contractors' Health, Safety and Environmental Case Guidelines for Mobile Offshore Drilling Units (the "*IADC HSE Guidelines*").

In general, the approaches adopted by the Industry and the Regulators commonly follow a four-pronged approach, to reply to the following questions:

[2] ISO 17776 "Petroleum and natural gas industries -- Offshore production installations -- Guidelines on tools and techniques for hazard identification and risk assessment"



1) Hazard Identification

Within the Hazard Identification process, the main sources of potential hazards and substance releases are identified and the initiating events that can cause such releases are determined. Common methods for Hazard Identification include the following:

- HAZIDs – HAZard IDentification studies, a well know systematic approach to identifying hazards within process industries;
- HAZOPs – HAZard and OPerability analysis, a more detailed review technique;
- PHA - Process Hazard Analysis, another systematic approach;
- What-If Analysis;
- FMEAs – Failure Modes and Effects Analysis;
- MLDs - Master Logic Diagrams, an approach for initiating event identification;
- Safety Reviews;
- SHIDAC - Structured Hazard Identification and Control process;
- Using industry standards and checklists;
- Fire & Explosion studies.

All foreseeable hazards should be identified in the RoMH including the whole life cycle of the installation. Therefore it is suggested that:

- Hazard identification takes into account all operational phases and critical areas of the installation;
- Hazard identification takes into account adjacent installations;
- Hazard identification takes into account domino effects.

2) Accident Sequence Analysis and Frequency Assessment

At this stage, a logic model for the installation is developed. The model has to include each and every initiator of potential accidents, as identified at the previous step (*hazard identification*) and the response of the installation to such initiators.

In this way, specific accident sequences are defined: they consist of an initiating event, specific system failures or successes (which can be either technical or procedural), and potential human responses.

Both prevention and mitigation measures should be included in the accident sequences. Bow-tie diagrams (Figure 5.2) can be used in this step.

Bow-ties

Bow-ties are diagrams depicting in a single graph both causes and consequences of a central event.

They consist of a Left Hand Side (LHS) which usually represents the prevention measures and a Right Hand Side (RHS) which displays protection and mitigation measures.

The Top Event (TE) may be an accident or, in general, an undesired event.

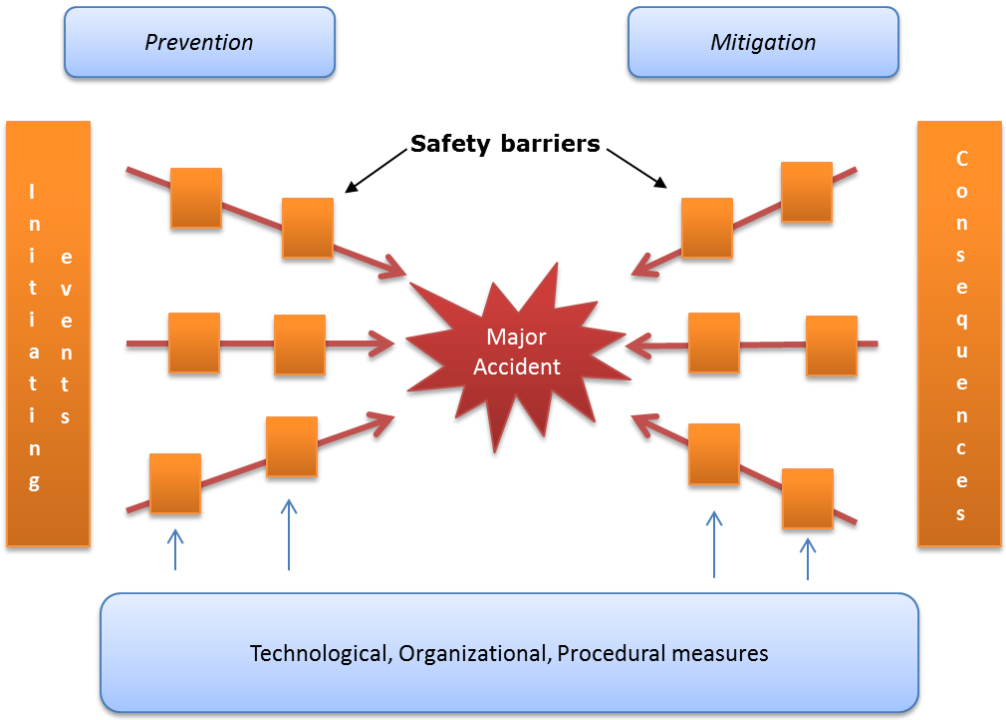


Figure 5 2. A typical Bow-tie diagram

The **Bow-tie methodology** is a commonly used approach to present accident sequences, thus facilitating *Frequency Assessment*.

Other approaches, such as the *Event Tree Analysis* and the *Fault Tree Analysis* are also widely used to provide logic models to calculate event frequencies. System failures are modelled in terms of basic component failures and potential human errors to identify their basic causes and to allow for the quantification of the system failure probabilities and accident sequence frequencies.

The most commonly used data sources (for the offshore industry) include the *SINTEF Offshore Blowout database*[3], the *OREDA Handbook*[4] and the *IOGP Risk Assessment Data Directory*.

3) Consequences estimation

Consequence Estimation is performed after the frequency assessment, in order to model the effects of the ranges of releases, blast pressures, etc.

[3] https://www.sintef.no/en/projects/sintef-offshore-blowout-database/
[4] https://www.oreda.com/

The main phenomena which should be modelled in the RoMH for both production and non-production installations include oil and gas releases which may in turn lead to:

- Hazardous substances dispersions (i.e. concentration calculations)
- Fires (heat radiation)
- Explosions (overpressure).

These phenomena can be modelled and their consequences estimated with various models as the Directive does not impose any specific model or methodology.
According to **ISO 17776,** the consequences on:

- People (P);
- Environment (E);
- Assets (A);
- Reputation of the company (R);

should all be estimated.

Consequences can be immediate or delayed, and damages can be either temporary or permanent.

4) Risk evaluation

Once the consequences of an event are also estimated, risk can be assessed as the combination of probability and consequences.

Risk = [Probability, Consequences]

Risk Assessment may be performed in various ways:

- qualitatively (usually not the preferable option);
- in a semi-quantitative way using risk matrices, or
- quantitatively, i.e. by performing a Quantitative Risk Assessment (QRA) with more elaborated techniques.

One of the most common representations of risk is through a **risk matrix**. A typical risk matrix - including the possible consequences to the different recipients listed above (People, Environment, Asset, Reputation) - is shown in Figure 5.3. The levels of the possible consequences are not univocal but are defined accordingly in every methodology. The same is valid for the definition of frequency or probability intervals.

The extent of the work contained in RoMHs on major hazard identification and risk assessment depends on the complexity of the installation.
This can best be expressed in Figure 5.4, which highlights the need for increasing depth of the various analyses as the complexity of the installation increases. For instance, the risk assessment work in a RoMH for a small unattended gas platform will be completely different from a mixed oil/gas production complex.

Consequences					Increasing yearly frequency					
					0	A	B	C	D	E
Severity	Persons	Environment	Asset	Reputation	Not plausible event It might occur in the E&P industry	Rare event Recorded in the E&P industry	Unlikely event It has occurred at least once in the Company	Plausible event It has occurred many times in the Company	Possible event It occurs several times/year in the Company	Frequent event It has occurred many times/year on a site
1	*Effect on health/slight injury*	*Slight effect*	*Slight damage*	*Slight impact*	1-0	1-A	1-B	1-C	1-D	1-E
2	*Effect on health/minor injury*	*Minor effect*	*Minor damage*	*Minor impact*	2-0	2-A	2-B	2-C	2-D	2-E
3	*Effect on health/significant injury*	*Local effect*	*Local damage*	*Local impact*	3-0	3-A	3-B	3-C	3-D	3-E
4	*Permanent disability or single death*	*Significant effect*	*Significant damage*	*National impact*	4-0	4-A	4-B	4-C	4-D	4-E
5	*Multiple deaths*	*Extended effect*	*Extended effect*	*International impact*	5-0	5-A	5-B	5-C	5-D	5-E

Figure 5 3 Typical Risk Matrix including consequences on different recipients (PEAR)

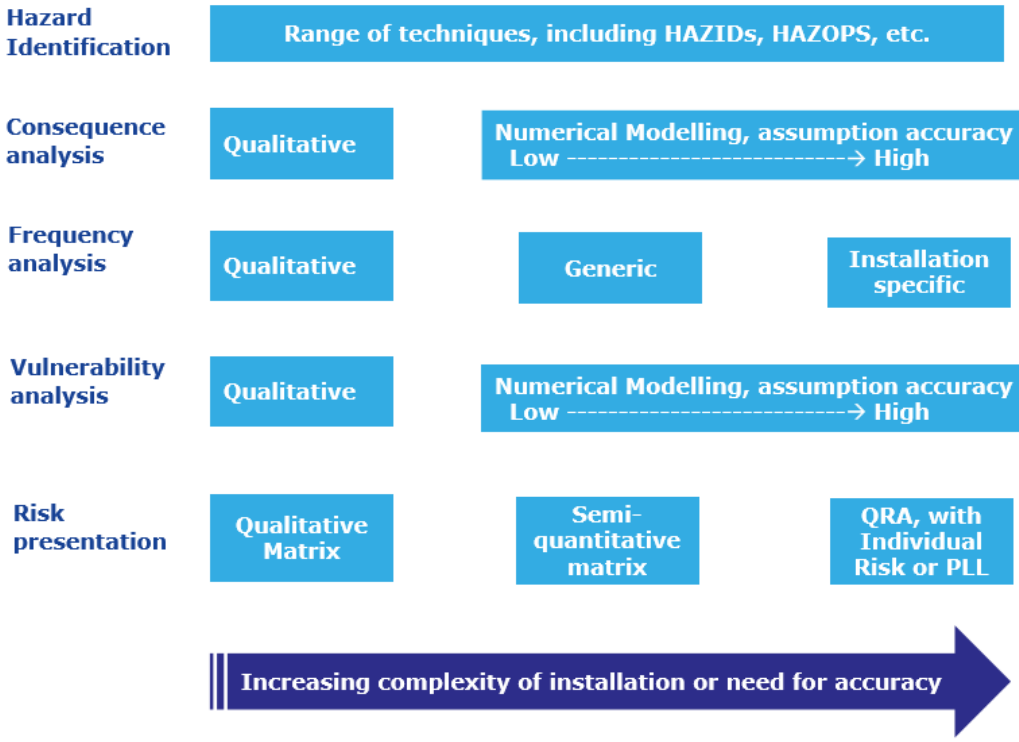


Figure 5 4 Appropriate levels of risk evaluation techniques

In assessing these aspects of a RoMH, CAs will need to refer to the requirements of Directive 2013/30/EU, and particularly ensure that the RoMH has all the required factual information.

The risk evaluation should take into account the entire life cycle of the installation, from design to subsequent decommissioning, focusing on how the proposed measures would reduce risk to an acceptable level, and whether good practice, sound engineering practice, and recent technical and technological advances have been considered. A list of questions to support CAs personnel during the assessment of the relevant part of the RoMH is provided in Annex 3.

Key Message:
It is important to verify that an operator or owner has identified the consequences in order to install ***proper control and mitigation measures****, using appropriate well-known methods.*

Key Message:
The final outcome of the Risk Assessment section of the RoMH should be the identification of the necessary control, protection and mitigation measures according to the identified hazards and potential risks, and their subsequent implementation, rather than the mere calculations and the resulting numbers.

5.2 Case Study

Exercise

Case study: "Marina" platform Simultaneous Operations with the Jack-Up "Offshore MODU"

Read the extract from the risk assessment report of the Marina Platform Combined Operations (see additional material) and answer the following questions:

a. *Does it meet the Directive's hazard and risk assessment requirements?*
b. *If not, what issues would you ask the operator to rectify, and why?*
c. *In which parts, will you ask for additional information and what would that be?*

Objective of the Exercise: *to gain experience in considering a RoMH, and to identify common challenges during the assessment process.*

Exercise Conclusion

The example of "Marina Platform" risk assessment shows that nice graphical representations do not necessarily imply a proper and consistent Risk Assessment process.

Although the document had several risk matrices for different operations performed on board, it still lacked some main features which are explicitly demanded in the Directive, i.e.:

- The list of activities was limited, particularly activities of combined/simultaneous operation;
- Events' likelihood and consequence description;
- Methods and techniques used for risk evaluation;
- Major hazard events were not clear;
- Correlation between mitigation measures and risk assessment results;
- Not clear if consultants were used to undertake this risk assessment.

In addition the following items were not included in this section of the RoMH:

- A general introduction in line with the RoMH, including number of workers, vicinity to sensitive areas, etc.;
- P&IDs, general layout of the installation, flow charts, etc.;
- Adherence to standards/guidelines, references;
- Roles and responsibilities of key personnel.

Some practical advice for CAs is not to "get lost" within the document during the assessment, but rather to focus on partial items, such as mitigation measures or risk assessment of specific activities.
Use the guidelines provided in **Annex 3** to facilitate and structure the assessment process.

Note. Risk Assessment and Hazard Identification results are the base on which the entire RoMH is developed. Therefore, they need to be of high quality and well supported.

6 Safety and Environmental Management Systems (SEMS)

- ✓ 6.1 SEMS Policy
- ✓ 6.2 SEMS Organisation
- ✓ 6.3 SEMS Procedures
- ✓ 6.4 SEMS Monitoring and Auditing
- ✓ 6.5 SEMS Review

The installation **Safety and Environmental Management System (SEMS)** is another key part of the operator or owner's arrangements for ensuring major hazard control. The SEMS features in various parts of the Directive, sometimes with overlapping requirements. In summary:

- The SEMS, or an adequate description, shall be included in the RoMH [*Article 11(1)(b), Article 19(3)*];

> ***Article 11 (1)(b)***
> *[…] the safety and environmental management system applicable to the installation, or an adequate description thereof, in accordance with Article 19(3) and (5).*
>
> ***Article 19 (3)*** *Member States shall ensure that operators and owners prepare a document setting out their safety and environmental management system which is to be submitted pursuant to point (b) of Article 11(1).*

- The SEMS shall include the broad aspects of Article 19(5)(b) and the specific Annex I (9) issues;

> ***Article 19 (5)(b)***
> *the safety and environmental management system shall be integrated within the overall management system of the operator or owner and shall include organisational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the corporate major accident prevention policy.*
>
> ***Annex I(9)***
> *The safety and environmental management system to be prepared pursuant to Article 19(3) and submitted pursuant to point (b) of Article 11(1) shall include but not be limited to:*
> *(1) organisation structure and personnel roles and responsibilities;*
> *(2) identification and evaluation of major hazards as well as their likelihood and potential consequences;*
> *(3) integration of environmental impact into major accident risk assessments in the report on major hazards;*
> *(4) controls of the major hazards during normal operations;*
> *(5) management of change;*
> *(6) emergency planning and response;*
> *(7) limitation of damage to the environment;*
> *(8) monitoring of performance;*
> *(9) audit and review arrangements; and*
> *(10) the measures in place for participating in tripartite consultations and how actions resulting from those consultations are put into effect.*

- The RoMH shall contain information regarding the SEMS that is relevant to the installation [*Annex I (2) (10) & (3) (11)*];

> ***Annex I (2), (3)***
> *Reports on major hazards …shall contain at least the following information:*
>
> ***Annex I (2) (10)***
> *information, regarding the operator's safety and environmental management system, that is relevant to the production installation*
>
> ***Annex I (3) (11)***
> *information, regarding the safety and environmental management system, that is relevant to the non-production installation*

- The **Corporate Major Accident Prevention Policy (CMAPP)** should also be submitted to the CA with the RoMH [*Article 11(1)(a) & Annex I (8)*].

> ***Article 11 (1) (a)***
>
> *Member States shall ensure that the operator or the owner submit to the competent authority the following documents: (a) the corporate major accident prevention policy or an adequate description thereof, in accordance with Article 19(1) and (5)*

In assessing the SEMS aspects of a RoMH, it is recommended to start with the CMAPP. The CMAPP is submitted with the RoMH, but it is not part of the RoMH. Therefore, it is not to be "accepted" by the Competent Authority. However, the RoMH's Safety and Environmental Management System has to be clearly linked to the CMAPP, and so if the CMAPP is deficient, so will the installation's SEMS.

The CMAPP is quite a high-level document, but is a crucial "umbrella" under which particular installations SEMS will function. Guidance when considering the adequacy of a CMAPP is given in Annex 4.

Standards relevant to offshore SEMS include the following:

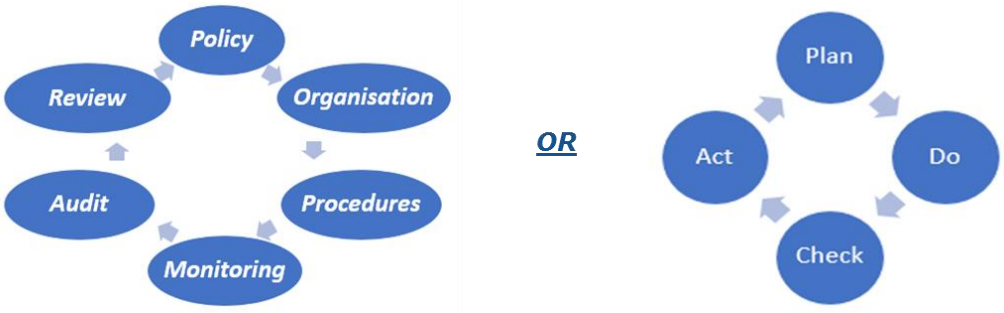
- ***ISO 14001*** – Environmental Management Systems;
- ***OHSAS 18001*** – Occupational Health & Safety Management Systems, which is due to be replaced by ISO 45001 in 2017;
- ***ISO 9001*** – Quality system Requirement.

In addition, **IADC MODU HSE Case Guidelines** and, to a lesser extent**, API RP 75**[5] also provide some helpful direction.

> ***Example.***
>
> *When the operator or the owner adopts a new SEMS at the production/non-production installation, following the change of installation's ownership or changes at a corporate level, then such SEMS should be reassessed. The definition of material change (as given in Article 2(30b) of Directive 2013/30/EU) would apply, therefore the amended RoMH would also need to be submitted to the Competent Authority.*

> ***Article 2, (30) (b)***
> ***Material change*** *means:*
> *- in the case of a notification of well operations or combined operations, a change to the basis on which the original notification was submitted including, inter alia, physical modifications, replacement of one installation with another, availability of new knowledge or technology and operational management changes;*

In general, the usual framework for SEMS in the offshore industry may follow either of two similar "*cycles*", i.e.:



[5] *Recommended Practice for development of a safety and environmental management programme for offshore operations and facilities*

In assessing the different aspects of the SEMS, Competent Authorities should first consider some high-level questions regarding the SEMS overall effectiveness:

- Is the SEMS structure logical and clear? Does it correlate to a standard?
- How well does the SEMS integrate into other company management systems?
- Can the SEMS actually be delivered on the installation? Is it up-to-date? Does it reflect existing arrangements/equipment?
- Does the SEMS overall clearly link with the CMAPP?

6.1 SEMS Policy

In then moving on to considering the "*policy or plan*" aspects of the SEMS, the following areas should *inter alia* be considered:

- Are the installation specific policies and objectives of the installation SEMS clear? For instance, are there annual installation HSEQ plans?
- Does the SEMS reflect and develop the high level/strategic safety and environmental policies and objectives in the CMAPP?
- Is there a demonstration of commitment from senior leadership?
- Is the relationship between the SEMS and other company management systems clear?
- What standards/guidelines were used for SEMS?
- How has the SEMS developed over time? This is particularly important where there has been a significant change such a change of ownership resulting in the introduction of new policies and management system approaches.

> ***Key Message***:
> *Particular attention to the SEMS Policy is required when an operator or owner registered outside a MS jurisdiction comes for the first time to operate in EU waters.*

6.2 SEMS Organisation

In relation to the assessment of the broad organisational aspects of the SEMS, the following should be taken into account:

- Organisational structure:
  - Are there clear organisational charts? Do they cover both for installation and onshore support teams and services (where relevant)?
  - Are the reporting lines to senior company management clear?
- Roles and Responsibilities:
  - Are HSE roles, responsibilities and authorities clearly defined and explained for all positions in the organisation? Generic or specific?
  - Are the SEMS roles/responsibilities sufficiently focused on MH risks and cover "leadership"?
  - Does the allocation of roles/responsibilities seem sensible?
  - Is workforce participation covered adequately?
  - Have resources been considered to match responsibilities? For instance, are there sufficient levels of knowledgeable, competent persons to cover the specific roles? Are there any staffing-level concerns? Is there sufficient provision for competent health, safety and environmental advice to line management?

6.3 SEMS Procedures

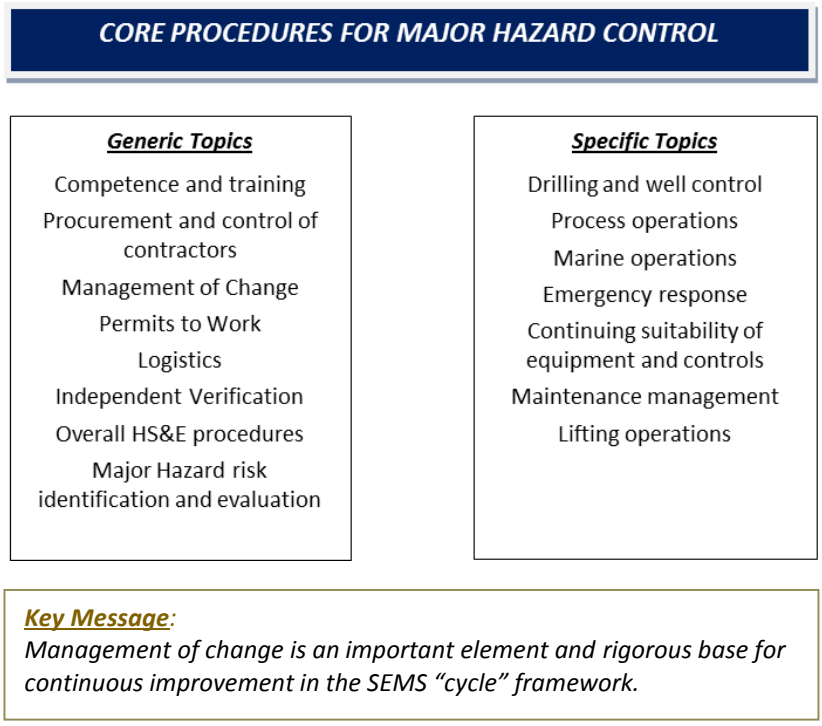
To be effective, procedures within an installation's SEMS should "flow" from the company's overall approach, rather than from the specific requirements of Directive 2013/30/EU. SEMS procedures will cover both major hazard and lower risk issues, but as part of the RoMH assessment there will be a need to focus on the major hazard areas.

An initial assessment of SEMS procedures should be carried out, before progressing to a more in-depth consideration of the core procedures for major hazard control. Initial assessment of suitability should include such issues as:

- Are the procedures logically selected? Do they cover the key MH issues?
- Are all the specific Directive topics covered?
- Is the overall process for establishing and maintaining procedures adequate and robust?
- Do they follow good practise/industry standards?
- Is sufficient attention given to human and organisational factors?

The next level of SEMS assessment should move to the procedures themselves, which will detail the hardware and management/organisational controls over a wide range of topics.

There is no defined list of "procedures" for major hazard control, as they need to be bespoke to the company and installation, and will depend on its major hazard profile. However, there is a core list of major hazard control procedures which will need to be comprehensively covered within any RoMH, as shown below:



***Key Message**:*
Management of change is an important element and rigorous base for continuous improvement in the SEMS "cycle" framework.

Detailed question sets for the assessment of such core procedures are contained in Annex 5. In addition, chapter 10 of this guideline describes in more details the assessment of the RoMH Independent Verification requirements, which can be considered as a sub-set of an installation's SEMS.

6.4 SEMS Monitoring and Auditing

Directive 2013/30/EU specifically requires the monitoring or audit arrangements within a SEMS (broadly equivalent to the "*Check*" phase outlined in the *"plan-do-check-act"* circle) to be included in the RoMH. It is sometimes difficult or irrelevant to judge when monitoring and auditing finishes and review starts.

Monitoring is the sum of the day-to-day activities which organisations do to ensure their performance on a continuous basis, whereas **Auditing** covers more formal, discrete compliance assessment. So, the assessment of both aspects together may be an adequate approach on occasions.

Monitoring
HSE daily reporting, occupational safety observations, walk through, good behaviour and best practices awards etc.

Monitoring could also include:

- *Day-to-day supervision activities;*
- *Management and employee representative workplace "inspections";*
- *Senior onshore management visits to the installation;*
- *Monitoring of a wide range of data, such as alarm trips, quality checks on Permits-to-work, environmental discharges, progress with planned maintenance programmes etc.;*
- *Incident and "near miss" reporting and investigation outcomes;*
- *Workforce behavioural safety initiatives/process;*
- *Results of independent verification activities.*

Auditing
Formal activity performed by an independent person outside the installation. It aims at verifying particular SEMS processes, implementation of procedures and corporate standards, etc.
The results of an audit should be incorporated into the continuous improvement of the SEMS framework.

When assessing the monitoring arrangements, CAs should ensure that the RoMH demonstrates that there is a comprehensive and deliberate process for monitoring health, safety and environmental performance:

- Does the SEMS cover both proactive and reactive monitoring processes?
- Is there a logical process to identify monitoring requirements?
- Is there a sufficient breadth of monitoring activities? Do they cover contractors' performance as well as core crew?
- Are the performance standards being monitored clear?
- Are the monitoring activities themselves covered by specific procedures?
- Is the appropriate level of management involved in reviewing monitoring results and taking actions?
- Is there an appropriate mix of effective leading and lagging indicators?

When assessing the auditing arrangements, CAs should expect a thorough description of the audit process, with details of the audit programme. Key issues to cover include the following:

- How are audit topics selected? Is the scope of the audits, and their style and frequency, appropriate?
- Details of the competency (and independence) of the audit teams, and their roles;
- How are the results of the audits reported back? How are they subsequently reviewed by the installation? How are appropriate levels of senior management involved?
- Is the system for monitoring the close-out of actions robust?
- How is the delivery of the audit programme monitored?

6.5 SEMS Review

Review is the final part of the *Plan->Do->Check–>Act* cycle and this small, but vital, part of the RoMH is also specifically highlighted in Directive 2013/30/EU. During the assessment of the SEMS review arrangements, CAs should look for:

- Evidence of a system for a periodic review of the whole of the SEMS arrangements. Is this led by an appropriate level of senior management?
- The mechanism whereby the findings from *reviews* influence the company's overall strategy/arrangements;
- A demonstration that the company has a process to proactively capture lessons from others in the industry – examples could include specific responsibilities on corporate HSE professionals to monitor global trends, the involvement in company staff in industry-wide safety or environmental initiatives, and specific benchmarking exercises.
- A commitment for continuous improvement.

7 Equipment and Arrangements

- ✓ 7.1 Use of Standards in RoMH Assessment
- ✓ 7.2 General assessment of "equipment and arrangements"
- ✓ 7.3 Assessment of Fire & Explosion aspects
- ✓ 7.4 Assessment of Well Control aspects

The logic of the RoMH process is that once the major hazard risks have been identified and assessed, appropriate control measures can be adopted. Directive 2013/30/EU contains requirements which focus on some key risk areas on offshore installations, and introduces specific requirements that the RoMH should contain, such as:

- *"*a description of equipment and arrangements to ensure well control, process safety, containment of hazardous substances, prevention of fire & explosion, protection of workers from hazardous substances, and the protection of the environment from an incipient major accident […]*"* [*Annex I (2)(7) & (3)(6)*];
- *"*a description of the arrangements to protect persons on the installation from major hazards […]" [*Annex I (2)(8) & (3)(7)*];
- "a demonstration that…major hazard control measures are suitable […]" [*Annex I (2)(5) & (3)(5)*].

As highlighted previously, these requirements in the Directive are slightly overlapping.

7.1 Use of Standards in RoMH Assessment

The RoMH is required to contain information about the "*relevant codes, standards and guidance*"[6] used in the construction and commissioning of the installation, and hence reference to such standards, guidance, etc., is a key part in establishing whether the RoMH demonstrates "*relevant good practice*".

However, a wide range of standards and guidelines are available for use in the offshore industry, and there is no unique list of standards.

OGP Report 426 "Regulators' Use of Standards"[7] gives some very helpful background to this, and identifies the ranges of standards and guidelines used by offshore regulators across the globe. Although it was published in 2010, the information contained therein is still very relevant.

Adherence to a code or standard is not necessarily a demonstration of safety, as it may be out-of-date, of limited technical relevance or application to the issue, or has a limited scope.

> ***Key Message***:
> *Reference to a code is not necessarily a demonstration of safety*

During the assessment, CAs should ensure that any quoted standard is appropriate, and - given the amount of overlapping codes (ASME, API, ISO, DNV, etc.) - consider whether the quoted standard/code is the appropriate choice. If in doubt, the CA should ask the operator/owner for further justification on the use of a particular standard, when a more appropriate one appears to be available.

An accepted hierarchy of standards/guidelines is available, as shown in Figure 7.1 below.

[6] Annex I, Part 2(9) and Part 3(8)
[7] http://www.ogp.org.uk/pubs/426.pdf

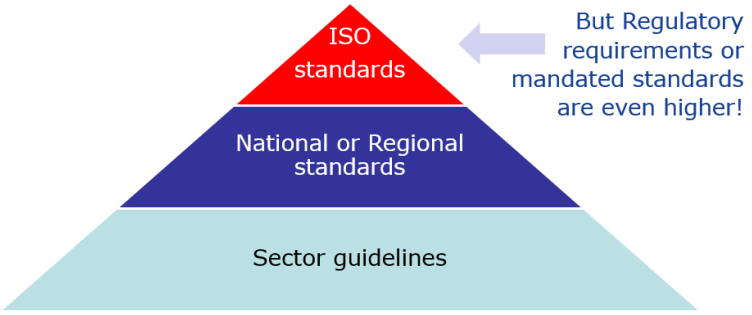


Figure 7 1 Hierarchy of standards

7.2 General assessment of "equipment and arrangements"

In assessing the *equipment and arrangements* sections of a RoMH, CAs will need to ensure that:

- Good practice, sound engineering principles and human and organisational factors have been taken into account for the range of issues;
- It is clear how the proposed measures reduce risk to an acceptable level;
- Risk management takes into account the life cycle of the installation.

There are some common issues which CAs will face when assessing RoMHs, and these can become particularly apparent when looking at equipment and arrangements. Such issues are summarised in the Table 7.1 below.

Table 7 1 Equipment and arrangements issues in RoMH assessment

Issue	Comment
1. Use of Generic statements and/or assertion of compliance with inadequate justification	E.g. *"Complies with all relevant codes"*, *"in accordance with IADC HSE MODU guidelines"*. More specific justifications/explanations may be needed to allow the CA to be convinced.
2. Variation in amount of technical detail in the RoMH.	A lack of sufficient detailed information will prevent the CA from fully understanding the issues, and hence prevent an adequate scrutiny. Conversely, too much information with questionable relevance to major hazard issues raises question of quality control of the RoMH by the operator/owner.
3. Emphasis on hardware descriptions, at the expense of procedures and hazard controls	The CA Assessment team will need to seek this additional information either from other parts of the RoMH, or via a request for more details.
4. Difficulty in matching particular sections of a RoMH to the detailed requirements of the Directive	As the Directive's requirements are not conducive to a "standard" RoMH layout, the assessment process will need to adopt a holistic approach, seeking additional information from different parts of the RoMH when considering specific Directive requirements.
5. Lack of reference to the installation's major hazard risks, or excessive emphasis on personal "occupational" injury scenarios	Raises doubts over whether the proposed control measures are sufficiently integrated to the major hazard profile. Seek further reassurance from the operator/owner.
6. Technical inconsistencies	To be dealt with as they arise.
7. Practical problems in understanding the RoMH. For example, widespread use of acronyms, poor pagination, or inadequate reference to more detailed plant layout diagrams and process flow information when necessary.	Needs to be raised at an early stage of assessment.

Two of the prime major hazards on offshore oil and gas installations arise from a **lack of well control** and from **fire and explosion** from the wide range of flammable substances which are likely to be present there (in a wide range of containment - from small bore pipework to large pressure vessels).

Directive 2013/30/EU specifically requires the RoMH to contain "*a description of equipment and arrangements to ensure well control and prevention of fire and explosion […*]". These aspects are dealt with in more detail in the following sections (7.3-7.4).

7.3 Assessment of Fire and Explosion aspects

Prevention of loss of containment of flammable substances is the key issue in case of fire and explosion. Loss of containment could have a wide range of causal factors, including inadequate initial integrity from poor initial design or installation, equipment operating outside its operating parameters, gradual integrity deterioration due to factors such as corrosion, fatigue or vibration, and even catastrophic deterioration.

The hierarchy of measures[8] that operators/owners should adopt within their RoMH **for the prevention of loss of integrity** should start at **designing out**, or reducing, the flammable hazard. For instance, optimising plant layouts, reducing inventories, ensuring separate jackets for accommodation and production, and even considering unmanned facilities, may be used to this purpose.

> ***Key Message***:
> *Design aspects should be verified prior to RoMH submission through a Design Notification.*

Prevention of hazardous loss of containment events is the following stage, which includes:

- maintaining the plant to design requirements;
- operating within design limits by implementing robust procedures/arrangements;
- managing modifications;
- establishing adequate periodic inspection regimes.

Once a loss of containment event occurs, issues often depicted on the right-hand side of the Bow-tie models become crucial, including **detection** that a loss of containment event has occurred, and the subsequent application of **mitigation** measures to reduce the consequences.
The final part of the loss of integrity hierarchy is the systematic approach to **Emergency Response** and **Environmental Protection**.

When considering RoMHs, Competent Authorities will need to assess whether the operator/owner has demonstrated a coherent approach in identifying their own fire and explosion (F&E) "*equipment & arrangements*". The quality of the work done to identify potential MH events is crucial, with the need for comprehensive F&E reviews/studies/modelling to obtain information on which to base the installation's prevention/mitigation measures, and thus influence the F&E equipment & arrangements on board.

Following the loss of containment hierarchy is one approach for the assessment of the Fire and Explosion sections of a RoMH, as described in the Table 7.2 below.

[8] This hierarchy of preventative measures is equally applicable to hazardous substance containment, i.e. another specific risk which Directive 2013/30/EU requires to be covered within the *Equipment & Arrangements* section of a RoMH.

Table 7 2 Measures for the prevention of loss of integrity

Integrity Hierarchy	Comments
1. Design considerations	E.g. ISO 13702:2015 "Control and Mitigation of F&E on Offshore Production Installations"
2. Adequacy of controls	▪ Operational procedures, including start-up and shut-down, which take into account human and organisational factors ▪ Maintenance procedures, including Permits to Work, modification approvals etc. ▪ Ensuring performance standards for associated systems (audit) and hardware (verification).
3. Detection issues	▪ Range of detectors likely, covering smoke, flame, flammable atmospheres, toxic gas etc. Location and types of detector should be based on outcomes of MH assessment and F&E/Hazardous substances modelling ▪ Alarms and alarm handling (especially control room) issues ▪ Arrangements when detection systems are degraded.
4. Source of ignition controls	Zoning for intrinsically safe electrical equipment.
5. Adequacy of mitigation arrangements	▪ Passive fire protection (e.g. main structural members and process vessels) ▪ Deluge and Sprinkler systems – what rates/coverage? ▪ Fire and Blast walls ▪ Other fire control equipment such as portable equipment.
6. Emergency response & Environmental protection	See chapters 8 and 9

7.4 Assessment of Well Control aspects

The information within the RoMH related to well control should reflect the fact that loss of well control can arise from a range of scenarios, including shallow gas formations, lack of pressure management during drilling and completions, failure of containment/control components, and dropped object damage. Well control is not just limited to the BOP – other equipment is necessary!

The structure recommended in the **IADC MODU HSE Guidelines** is generally used in RoMHs for mobile drilling units. With respect to equipment and arrangement, the guidelines follow the drilling process, from handling "tubulars" (drill pipe and casing), the mud and cementing systems, Blowout Preventer systems, and also covering any subsea capability.

CA assessment should look for a **clear demonstration that well control systems are designed, constructed and maintained to appropriate standards**, and that the **control systems** provide for the range of drilling activities which are anticipated.

The RoMH should not just contain a description of the installation's hardware, but needs well control arrangements as well, such as:

- Standard Operating Procedures;
- Well Control Manual;

- Initial competency assurance;
- Continuing competency arrangements, such as drills;
- Well monitoring process, for example kill sheets.

> ***Example.***
> *At the time of submission of a RoMH, the owner of the drilling rig may not possess complete (geological) information on the reservoir which would justify the choice of specific equipment. However, the RoMH should include sufficient information to identify the range of reservoirs for which its equipment would be suitable, for example a description of the rig's maximum drilling capability (i.e. drilling depth, pressure drilling pump, etc.) and capability for components' adjustment, such as additional BOP components.*

Well Control equipment and arrangements should not just be limited to Non-Production RoMHs, but should also feature in Production RoMHs. For instance, arrangements for continuing well integrity monitoring, procedures for Combined Operations involving well entry, and well work-overs should also be considered.

Exercise

The "Drill King" drilling rig is contracted to undertake an exploratory drilling programme in your waters, as soon as it has completed its current drilling programme in the Gulf of Mexico. When the rig owners, Regal Drilling Inc., submit the RoMH for your acceptance they assure you that it complies with the latest edition of the IADC MODU HSE Case Guidelines, V3.6, which they emphasise, have been updated following the Directive 2013/30/EU. They also state that all the information relating to well control equipment and arrangements were contained in Part 3 of the RoMH, which is attached.

The full text of the extract from Section 3 of the *Drill King* RoMH is found in Annex 8.

Read the extract from the Drill King RoMH, and then answer the following:

a. *What difficulties did you have, as an individual, in considering and understanding the Drill King RoMH? What additional expertise you would you need with the project team to help assess this topic?*
b. *List the areas where you feel the RoMH is insufficient to enable you to accept that the Drill King's well control equipment and arrangements, "if implemented, meet the requirements of the Directive". For each of the areas, decide on the action you would ask Regal Drilling to take to resolve your concerns.*

Objective of the Exercise: *to gain experience of some of the challenges encountered during the assessment of a RoMH.*

Exercise Conclusion

Common issues when assessing RoMHs:

1. **Use of generic statements** – e.g. "standard layout", "Yutson class", "all relevant codes" etc.
2. **Assertions of compliance, with inadequate justification** –e.g. "complies with the MODU Code", "accepted by Classification Bodies", "in accordance with IADC HSE guidelines" etc.
3. **Lack of sufficient detailed information** to allow full understanding or scrutiny.
4. Conversely, sometimes **too much information** on some issues, with questionable relevance to major hazard risks unclear – why such inconsistency? Is it just "cut and paste"? Could indicate lack of quality control or ownership of RoMH.
5. **Emphasis on hardware description** at the expenses of procedures and their adequacy.
6. **Process flow charts** - no reference, or inability to access, process flow charts, layout diagrams P&IDs etc.
7. **Lack of reference to identified Major Hazard risks** – does this indicate a lack of integration of the installation equipment/procedures to its major hazard risks?
8. Issues of **Acronyms** – e.g. WRTS (Wireline Riser Tensioner System), HPU (Hydraulic Power Unit), APV (air pressure vessel) etc.
9. **Emphasis on personal injury.**
10. Ignores obvious hazardous chemical issues – mud and chemical mixing/handling, radioactive source handling/storage etc.
11. **The holistic nature of RoMH assessment** – very difficult to deal with well control just with this RoMH Part 3 – other issues such as training/competence, procedures, hazard identification are all required.
12. **Technical inconsistencies** – e.g. BOP (6000') does not match proposed depth (7000'), and choke & kill manifold pressure (12000 psi) is less than the BOP max rated pressure (15000 psi)
13. **Lack of Competent Authority expertise** in some areas of technology.

8 Emergency Response: Safety Aspects

- ✓ 8.1. Internal Emergency Response Plans
- ✓ 8.2. What to look for when assessing a RoMH

This Section covers the assessment of the emergency response aspects of a RoMH. It focuses on the safety aspects for those on the installation, whereas the consideration of the potential for subsequent environmental response is covered separately in Chapter 9.

During the consideration of RoMH's emergency response arrangements, it is important that Competent Authorities bear in mind the links between the internal actions by the operator or owner following an emergency and the wider requirements in Directive 2013/30/EU (Article 29) for Member States to prepare their own external emergency response plans with respect to the offshore oil and gas installations in their waters.

These external plans, which include the role of the Member State in coordinating and responding to industry response, may not be under the responsibility of the Competent Authority within the relevant Member State, but are likely to be under other public authorities, such as the Coast Guard service or the Navy.

With respect to RoMH's emergency response arrangements, Directive 2013/30/EU requires the RoMH to contain:

- a "description of the arrangements to protect persons from major hazards, and ensure safe escape, evacuation and rescue…and arrangements to prevent damage…to the environment in the event that all personnel are evacuated". [*Annex I (2) (8) & (3)(7)*];
- "an internal emergency response plan or an adequate description thereof" [*Annex I (2) (11) & (2) (12)*].

> ***Annex I (2)(8)***
>
> *"a description of the arrangements to protect persons on the installation from major hazards, and to ensure their safe escape, evacuation and rescue, and arrangements for the maintenance of control systems to prevent damage to the installation and the environment in the event that all personnel are evacuated"*
>
> ***Annex I (3)(7)***
>
> *"a description of the arrangements to protect persons on the installation from major hazards, and to ensure their safe escape, evacuation and rescue, and arrangements for the maintenance of control systems to prevent damage to the installation and the environment in the event that all personnel are evacuated"*

8.1 Internal Emergency Response Plan

The installation's Internal Emergency Response Plan (IERP) needs to include, as a minimum, defined information as required by Annex I (10) of Directive 2013/30/EU, summarised in Table 8.1.

Emergency response arrangements within a RoMH are often based on specific reports from marine or other consultants or specialists.

The arrangements should be based on a clear identification of the major hazard events which give rise to fires and explosions, and other significant events such as ship collision, exceptional weather, ballasting problems, etc., which could result in the need to take immediate action to protect the safety of personnel, even leading to their prompt removal from the installation.

Part of the work in identifying such arrangements should include the identification of the standards of performance of the measures for protecting personnel and ensuring effective evacuation and escape, and subsequent rescue.

Table 8 1 Minimum content of Internal Emergency Response Plans (pursuant to Directive 2013/30/EU)

Internal Emergency Response Plan – Content [Annex I (10)]
▪ Names/positions of persons initiating and directing internal emergency response procedures, and for liaising with external emergency response authorities; ▪ Arrangements for providing "early warning" of a major accident to external authorities and for coordinating internal and external response; ▪ Description of all foreseeable events which could cause a major accident; ▪ Description of actions to control conditions/events and limit their consequences; ▪ Description of the equipment and resources available; ▪ Arrangements for limiting risks to persons/environment, including how warnings to be given, and actions expected; ▪ Arrangements for training personnel in the duties they will need to carry out; ▪ Arrangements for Combined Operations, coordinating escape, evacuation and rescue between the installations; ▪ Internal Emergency Response Plan requirements for environmental aspects (covered in Chapter 9).

Directive 2013/30/EU specifies three stages in emergency incident management, i.e. ***protection***, ***evacuation*** and ***escape***.

> ***Protection*** *refers to the actions needed to secure the safety of personal on the installation whilst a major accident/incident is in progress and before conditions are controlled or personnel are able to be evacuated from the installation platform. The prime "protection" arrangement is the provision of temporary safe refuges.*

> ***Evacuation*** *refers to the controlled removal of personnel from the installation via their primary means of evacuation such as using the installations normal methods of personnel transfer access (e.g. helicopters) or the prime designated mass evacuation methods such as lifeboats or TEMPSCs (Totally Enclosed Motor Propelled Survival Craft).*

> ***Escape*** *refers to the use of the installation's secondary means of evacuation when the primary means are not available. This includes a mass event (for instance when the primary TEMPSC are unable to be launched) or an escape of individuals who have become isolated on the installation from their designate primary evacuation means.*

Guidance on these various aspects of offshore emergency response is contained in the following publications:

- **ISO 15544:2000** "*Petroleum and Natural Gas Industry – Offshore Production Installations – Requirements and Guidelines for Emergency Response*";
- **IADC MODU HSE Case Guidelines** (Part 5);
- **IMO MODU Code for Construction & Equipment of MODUs**.

8.2 What to look for when assessing a RoMH

Table 8.2 identifies key areas for scrutiny during the assessment of the protection/evacuation/escape aspects of the arrangements in the RoMH.

Table 8 2 Key aspects for Scrutiny

Key aspects for Scrutiny	Comments
1. Is there a clear command structure?	Roles and responsibilities of the team should be well defined, remembering contingency arrangements to duplicate roles.
2. Selection and Competency of emergency team.	To include both initial and refresher training requirements for the emergency team, including drills, "table top" practice exercises.
3. Adequacy of response strategies.	Do they cover all identified major accidents, including adverse weather?
4. Instructions and training of everyone on the installation.	Both general emergency response and survival training, and installation specific briefings and familiarity.
5. Adequacy of arrangements for communication during emergencies.	▪ The installation visual and audible alarms should be adequate for all on the installation – remember vulnerable positions such as divers. ▪ Are contingency arrangements in place for communication systems during emergencies? ▪ What about the adequacy of wider communication arrangements with onshore management, adjacent installations, coastguards etc.?
6. Access to muster points and temporary refuges during emergencies.	▪ Sufficiently protected designated routes and alternative arrangements, based on endurance time data. ▪ Design and location of emergency lighting and escape indicators. ▪ Any necessary PPE arrangements to reach temporary refuges (e.g. smoke hoods, escape respirators etc.)
7. Temporary Refuges (TRs) and muster stations.	▪ Location of primary and secondary TR. ▪ TR design considerations (e.g. endurance time, impairment due to H2S, O2, smoke) and maintenance aspects (e.g. HVAC systems).Storage and specifications for survival suits, life jackets and PPE for emergency responders (firefighting, etc.).
8. Evacuation issues.	Primary means of evacuation should be normal route on/off installation, but alternative means (usually evacuation by sea) needed to take into account the range of emergency scenarios.
9. Lifeboats and TEMPSCs.	▪ Issues such as design, location, numbers, etc., should take into account need for additional capacity for contingencies – 150%?Arrangements for launching, crewing.
10. Means of escape when evacuation not possible.	▪ Wide range – including shutes, descenders, fixed ladders and stairways, plus life rafts or direct to sea. ▪ A clear rationale behind choice, location, redundancy etc., taking into account any limitations and issues with actual deployment/use.

However, RoMH scrutiny also needs to include the arrangements for the **safe recovery of personnel** from either their prime means of evacuation, such as the lifeboats, or from secondary methods of escape which will also include personnel being in the sea. Such rescue procedures should be based on a range of scenarios, and will almost inevitably rely on external facilities, such as standby vessels with rescue capability or larger Emergency Response and Rescue Vessels (ERRVs), although more limited events could involve installation-based fast rescue craft. Rescue arrangements within a RoMH would need to demonstrate such issues as:

- The rescue response and capacity matches sea immersion survival times;
- Effective arrangements are in place for retrieving survivors for the range of potential scenarios, including from life rafts and directly from the sea;
- The rescue response arrangements take into account limitations such as sea states, helicopter operating windows, ERRV availability;
- Appropriate arrangements and facilities for the medical treatment of survivors.

Exercise

Read the extract from Section 7 of the Drill King RoMH which relates to Emergency Response (the full text is found in Annex 9), then answer the following questions:

a. *Are the emergency response arrangements based on a clear identification of the major accident emergency events? What additional information would you need to assess?*

b. *Identify the individual responsibilities on board Drill King when responding to a major emergency. What additional information would you expect to find elsewhere in the RoMH or in supporting documents?*

c. *The RoMH is light of the details of the evacuation and escape arrangement, so you ask Regal Drilling for the Drill King ERP. What sort of information would you expect it to contain relating to evacuation/escape equipment and muster stations?*

Objective of the Exercise:

- *To identify the types of additional material you should expect to be available when considering a RoMH;*
- *To gain experience on assessing strengths and weaknesses in a RoMH;*
- *To consider in detail some key aspects of evacuation and escape.*

9 Emergency Response: Environmental Aspects

- ✓ 9.1. The relationship between safety and environmental emergency response
- ✓ 9.2. What to look for when assessing the environmental response aspects of a RoMH – The Environmental Impact Assessment

9.1 The relationship between safety and environmental emergency response

This chapter is complementary to chapter 8 on the safety aspects of emergency response, as environmental response following a major incident should follow seamlessly from safety response. Once safety is assured, the focus of the emergency response should shift to protecting the environment.

Chapter 8 describes the generic requirements of Directive 2013/30/EU with respect to emergency response arrangements in the RoMH, and these are as applicable to environmental protection and response as to the safety aspects covered in the previous chapter.

However, the Directive has some additional specific environmental protection and response requirements, i.e.:

- The detailed requirements for the Internal Emergency Response Plan (IERP) listed in Annex I (10) should also include:
  - Arrangements to limiting risks to the environment;
  - An estimate of oil spill effectiveness/an analysis of the oil spill response effectiveness, taking into account some defined aspects;
  - Evidence of prior assessment of any dispersant chemicals to minimise environmental damage;
  - Description of the equipment and resources available for capping any potential spill;
  - Coordination between internal and external response plans;
- Operators and owners should prepare an ‘‘inventory’’ of equipment to implement the IERP, and this equipment will be particularly linked to their environmental response arrangements [*Article 19(6) & Annex IV*].

> ***Article 19 (6)***
> *Member States shall ensure that operators and owners prepare and maintain a complete inventory of emergency response equipment pertinent to their offshore oil and gas operation.*

- The RoMH should contain an assessment of potential environmental effects resulting from a loss of containment of pollutants arising from a major accident, and a description of the technical and non-technical measures to prevent, reduce or offset them, including monitoring [*Annex I (2) (16) and (3)(16)*].

It is useful to bear in mind that, in the past, offshore *environmental protection* issues have been dealt with separately from *safety* issues. Although Directive 2013/30/EU only refers to one IERP, there should be no major difficulty if the operator or owner has a separate internal Oil Spill Response Plan purely aimed at those internal emergency responses arrangements related to environmental protection.

There is a wide range of potential environmental incidents from offshore installations, and these are often designated into three categories:

- **Tier 1** – small events, capable of being dealt with by the installation itself;

- **Tier 2** – larger events, requiring assistance from others, but with consequences relatively confined to a local area;
- **Tier 3** – exceptional events, with environmental impact over a wide area, possibly even internationally.

Tier 1 events are not likely to generate major environmental incidents as defined in the EU Directive, so the focus is on **Tier 2** and **Tier 3**, which is also the scope of the External Emergency Response Plan (see chapter 8) that the Directive requires Member States to prepare.

Marine oil pollution is not new, and a range of bi-lateral/multi-lateral agreements and organisations for Tier 2 and 3 incidents already exist, such as the Bonn Agreement (for North Sea countries) and the Barcelona Convention (for the Mediterranean countries), REMPEC, EMSA and OSRL. There is a range of guidance on offshore environmental response, including:

- IPIECA good practice guides (http://www.oilspillresponseproject.org/response/);
- Oil & Gas UK guidelines:
  - Guidelines for the Management of Emergency Response for Offshore Installations;
  - Guidelines for the management of competence & training in emergency response for offshore installations;
  - "*Oil Spill Response Tool Kit*", which includes guidance on aerial surveillance, aerial dispersant, etc.;
  - "The Oil Spill Response Effectiveness in UK Waters", which provides generic assessment of response effectiveness, to which specific regional weather data can be added.

9.2 What to look for when assessing the environmental response aspects of a RoMH – The Environmental Impact Assessment

Before considering the adequacy of the environmental aspects within a RoMH, it is highly recommended that those involved in the Competent Authority's assessment team are fully aware of the Environmental Impact Assessment (EIA) which is relevant for the particular offshore installation.

The submission of EIAs for offshore oil & gas development is required by Directive 2011/92/EU (EIA Directive), and is part of the regulatory process that ensures that Member States take into account potential environmental implications of any offshore oil and gas development before any decisions to approve/authorize that development are made. The EIA will have been submitted well before any individual RoMH is received.

Although the Member State's offshore safety Competent Authority may or may not have a stake in the EIA authorization process, the information in the EIA will be of significance when subsequently considering the adequacy of any installation's environmental protection response arrangements.

The CA assessment of the environmental aspects of a RoMH ought to be aimed at the consequences of major environmental incidents, which are primarily the result of oil spills or discharge. The focus of the environmental response arrangements will move away from the installation systems and onto the roles of the onshore emergency response teams and environmental response contractors.
Key areas to assess are detailed in Annex 6, which provides a set of detailed questions for consideration during the RoMH assessment, and covers the following issues:

- Environmental response management systems;
- Use of environmental response contractors;

- Oil spill response equipment – storage, mobilising, etc.;
- Training;
- Different approaches to oil spill response – dispersants, booms, burning, surveillance, etc.;
- Use of modelling, both in planning for scenarios and also real-time during an event;
- Well capping devices and relief well drilling;
- Likely effectiveness of oil spill response;
- Coordination between Internal and External Emergency Response Plans.

Exercise

A "Contingency Plan" has been included within a RoMH for a normally unattended oil and gas platform, situated 10 km from the coast and the onshore facilities. It is the installation's Internal Emergency Response Plan with respect to environmental issues.

The full text of the Contingency Plan can be found in the additional material.

Consider the document under the broad assessment topics in the table, and comment on the key assessment issues.

10 Independent Verification Schemes

- ✓ 10.1 Independent Verification
- ✓ 10.2 Case Study

10.1 Independent Verification

The requirement for an offshore installation's Independent Verification Scheme is a relatively new development for offshore operators or owners working in some Member States. However, it is an important requirement of Directive 2013/30/EU:

- A description of the scheme of independent verification should be included with the RoMH [*Article 11(1)(d)*];
- The scheme should include the broad aspects of *Article 17*;
- The selection of the independent verifier, and the scheme itself, should meet the criteria listed in *Annex V [Article 17(3)]*;
- The RoMH should contain a "description of the independent verification scheme" [*Annex I (2)(12) & (3)(13)*], which should in turn include the specific issues outlined in Annex I(5).

Note. *The Independent Verifier – as defined in Directive 2013/30/EU – does not necessarily have to be a third party verifier. However, the verifier should meet the criteria of Annex V.*

Note. *Independent Verification is a requirement imposed on operators and owners:*

- *Operators and owners set up the scheme and frequency of the verifications;*
- *Operators and owners decide what financial resources are to be invested into the verification process;*
- *Directive 2013/30/EU does not request independent verifiers' certificates check, it is in the hands of operators/owners to accept the Independent Verifier's technical proficiency.*

The CA does not assess or approve the verification scheme, however:

- *the CA may encourage the operator or owner to consider Independent Verification as a layer of additional protection, rather than as a repetition of the already set-up assurance program;*
- *Independent Verification is part of the RoMH, so in case CA assessment finds significant falls or queries related to the amount of examinations performed or if there are doubts on the verification scheme, the CA may raise it as part of CA questions on the RoMH.*

Example. *In Ireland, before submitting the RoMH, the operator/owner must submit their choice of the Independent Verifier to the CA. The CA, in turn, would have to approve the Independent Verifier (or Independent Competent Body, as termed in the Irish framework).*

Common issues relating to assessment of the verification aspects of RoMHs include the following:

- The consideration of the independence of those involved in verification, and the interaction between verification and the marine surveys undertaken by vessel classification societies;
- The importance of the RoMH clearly demonstrating how the SECEs have been comprehensively identified, and for assessors being confident about the sufficiency of the areas identified as safety or environmentally critical;
- The mechanism whereby performance standards are developed following the identification of SECEs;
- The link between performance standards and the verification inspection or examination activities, including the difference between the verification activities for "active" and "passive" systems;

- The challenge of ensuring that third party and contractor SECEs are included in the overall installation verification system.

A range of assessment activity is therefore required by CAs. Firstly, some broad issues to explore include the following questions:

- Are the specific Directive requirements covered (for both the Verification Scheme itself and the selection of the Independent Verifier)?
- Is there a logical and comprehensive process from Hazard Identification -> SECE identification -> Performance Standards -> Verification inspections/examinations?
- How are the results of the verification activities used to maintain and improve safety and environmental protection? Are they supported by senior management?

Secondly, the SEMS assessment guidance in Annex 5 (previously introduced at chapter 6.3) provides a set of further detailed questions for consideration during the assessment of the verification scheme aspects of a RoMH.

Suggestion:
An example of list of Safety and Environmental Critical Elements (SECEs) list can be found in Commission Implementing Regulation EU 1112/2014. [Section C].

10.2 Case Study

Exercise:

The Production Princess FPSO is shortly to be moved to your waters after the completion of five years in the South China Sea. They have submitted a RoMH, and you have been asked to decide whether the independent verification arrangements for this FPSO - as described in the extract from Section 5.4 of the RoMH in Annex 10 - are sufficient to allow your Competent Authority to accept it.

The full text of Section 5.4 of the *Production Princess FPSO* RoMH is found in Annex 10.

Read the extract from the RoMH, then answer the following:

a. *Using the "Assessment of Core SEMS" handout, list the general areas where you feel that the RoMH is insufficient to allow you to accept the Production Princess' verification scheme arrangements.*
b. *For each of the areas, decide what additional information you would ask for.*
c. *Review the table of SECEs. Are there any broad areas which have been omitted? What are they?*
d. *Consider the fire protection SECEs for process vessels involving (i) sea water deluge and (ii) passive fire protection of process vessels. For both, what sort of performance standards would you expect, and what sort of verification inspection/examination would you consider to be appropriate?*

Objective of the Exercise: *to gain experience in considering verification issues in RoMHs.*

Exercise Conclusion

Common issues relating to the assessment of verification aspects of RoMHs:

1. The importance of the RoMH clearly demonstrating **how the SECEs have been comprehensively identified**.
2. The consideration of the **independence** of those involved in verification, and the interaction between verification and the marine surveys undertaken by vessel classification societies.
3. A broad feeling about the **sufficiency of the areas identified** as safety or environmentally critical – this RoMH omits a range of process SECEs such as containment and over-pressurisation elements and environmental spill response.
4. The importance of how **performance standards** are developed following the identification of SECEs.
5. The challenge of ensuring that 3rd party and contractor SECEs are included in the overall installation verification system.
6. The link between performance standards and the verification inspection or examination activities, including the difference between the verification activities for “active” and “passive” systems.

11 Post Acceptance Issues

- ✓ 11.1 Material Changes
- ✓ 11.2 Well Operations Notifications
- ✓ 11.3 Combined Operations
- ✓ 11.4 Other notifications
- ✓ 11.5 Inspection and investigation

Although the conclusion of the Competent Authority's RoMH assessment process is when the letter of RoMH acceptance is issued to the operator or owner, Directive 2013/30/EU does not anticipate that this will be the end of the CA involvement with the installation concerned. Figure 4.1 identified a number of other formal processes where further CA acceptance or action is required during the lifecycle of the installation and, in addition, the Directive has expectations for the CA's role in inspection, investigation and enforcement. This Section covers these post-acceptance issues.

11.1 Material Changes

A material change to a RoMH is "a change to the basis on which the original report was accepted" [*Article 2(30)*].

Material changes can include physical modifications on the installation, operational management changes, and "availability of new knowledge and technology".

Where material change modifications are to be made to an installation, the operator or owner has to first submit an **amended RoMH** to a deadline set by the relevant CA, and **the proposed modifications cannot be brought into use until the Competent Authority has accepted the amended RoMH.**

Guidance in previous chapters of this report will be applicable to the assessment parts of a proposed amended RoMH following a material change notification. CAs are advised to focus their considerations on the actual change being put forward, as this is not an opportunity for another full RoMH assessment. It is important to create an assessment team to match the scope of the material change - most material change RoMH assessments will need a mixture of engineering, management system and human factor expertise. The CA must ensure that there is a clear allocation of assessment tasks, depending on the actual detail of the material change.

Directive 2013/30/EU specifies in *Annex I, Part (6)* what is to be included in a material change notification. Therefore, the first task of considering such a notification is to ensure that it provides the required details:

- ➢ Does the notification include a proposed amended RoMH and internal emergency response plan, with sufficient details of the change?
- ➢ Is there a demonstration that Major Hazard risks are reduced to an acceptable level?
- ➢ Is there a summary of the worker involvement in the revised RoMH?

Also, it must be ensured that the CA assessment can be undertaken in an efficient manner, and that changes with respect to the original RoMH are clear.

Key Message:
Any changes from original RoMH shall be "highlighted", it should be clear what operator or owner proposes to change.

Some practical assessment guidance for material change assessment is the following:

- Is the breadth of the operator or owner's risk assessment process adequate for the change?
- Be careful about "**reverse risk**" [9] arguments.
- Are all the consequences of the change identified?
- An assessment of how well the installation's own Management of Change (MoC) processes have been used for this material change will provide useful information upon which to aid an acceptance decision.
- How well has the independent verifier been involved in this material change? Have their views been taken into account and, if not, why not?
- How have human factor implications for the proposed material change been identified?

***Key Message**:* The CA shall carefully verify the arguments for Material Change. Material Change shall not impact on the existing safety aspects.

***Example of incorrect "reverse risk" argument in case of material change**. "…Several release valves of a pressure vessel are going to be removed, because of inaccessibility of their positions. Maintenance of these valves requires additional time and resources, and exposes maintenance workers to additional risk. Instead, such resources will be devoted to other safety aspects, such as life boat maintenance".*

11.2 Well Operations Notifications

A ***Well Operation*** is "*any operation concerning a well that could lead to a release…that has a potential for a major accident*" [*Article 2(24 – OSD)*]. Before undertaking a well operation, the well operator should submit a notification to a deadline set by the CA.

***Example.** The setting of the deadline lays within specific CA powers. For example, according to the Irish legislation, Well Operations Notifications shall be submitted six months prior to the commencement of the operations, while in the UK this period is 21 days.*

A Well Operations Notifications shall provide comprehensive information, such as:

- Full details of well work programme;
- A risk assessment;
- Details of any environmental, meteorological and seabed limitations;
- A well examination report from the Independent Well Verifier;
- A suitability statement for the well operator, linked to the well verifier's report.

Additionally, installations involved must have an accepted RoMH before well operations can commence.

In responding to a Well Operations Notification, Competent Authorities need to appreciate that their role is slightly different from a material change notification. Directive 2013/30/EU requires the CA to "consider" the well notification, and "if necessary take appropriate action […] which may include prohibiting […]".

[9] **Reverse Risk**. Some changes may initially alter the risk profile by increasing some risks, but that can be satisfactory if additional control measures are taken to lower the risk back to an acceptable risk. However, an argument sometimes put forward to justify cost cutting or "efficiency" changes is termed a "reverse risk "argument, where the justification of removing some layers of protection (and thus increasing the risk) is that lower costs will release resources which can be used for other safety or environmental protection systems elsewhere on the installation. That is not an acceptable approach.

Thus, the CA does not give specific acceptance to a Well Operations Notification, but has a duty to make some sort of regulatory response if it has concerns. In addition to this initial notification is the requirement in the Directive for well operators to submit subsequent *weekly* reports to the CA, giving a summary of progress [*Article 15(4)*]. Therefore, the Directive anticipates ongoing CA oversight of such a well operation.

Time is ticking as soon as the notification is received, as the onus is on the CA to take action "if necessary". In the absence of any such action within the specified deadline, the well operation can go ahead.

Upon receipt of a Well Operations Notification, the CA should initially scrutinise it to ensure the details meet all the Directive's requirements, and then undertake a more in-depth consideration to assess whether the details of the notified operation are sufficiently in accordance with good practice to avoid the need for immediate CA action.

In this respect, the report from the operator's Independent Wells Verifier is very important, but CAs should not solely rely on findings of suitability within the Verifier report for their own CA decisions.

Well operations are often highly technical, so it is inevitable that a CA will need well or reservoir engineering technical support to understand and scrutinise the notification. Such arrangements and resources will need to be available at short notice to match the CA's expressed deadline for such notifications. It is recommended that CAs establish good communications with their well operators, so that they have good intelligence about potential well operations before notification, to aid future resource planning.

> ***Article 15 (4)***
> *Member States shall ensure that the operator of the well submits reports of well operations to the competent authority in accordance with the requirements of Annex II. The reports shall be submitted at weekly intervals, starting on the day of commencement of the well operations, or at intervals specified by the competent authority.*

11.3 Combined Operations

A ***combined operation*** occurs when one offshore installation works with another installation in an operation which could materially affect the safety and/or environmental risks on either installation.

> ***Article 2 (25)***
> *"**Combined Operation**" means an operation carried out from an installation with another installation or installations for purposes related to the other installation(s) which thereby materially affects the risks to the safety of persons or the protection of the environment on any or all of the installation.*

Before undertaking such a combined operation, the respective operators/owners should jointly prepare a ***Combined Operations Notification*** to the CA, to a deadline set by the CA.

> ***Example.*** *According to the UK legislation, Combined Operations Notifications shall be submitted at least 21 days prior to the commencement of the operation.*

A notification of combined operations shall contain the following:

- A description of the operation, and a programme of work;
- Details of any equipment not described in either of the existing RoMHs;
- A *bridging document*, agreed by both installations, of how the SEMS of the installations will be coordinated;

- A summary of risk assessment, including risk controls.

In handling a Combined Operation notification, the role of the Competent Authority is similar to wells notifications, i.e. one of considering and taking action if necessary, rather than "acceptance". The CA focus should be on the interaction between the two installations, and the effects that one installation could have on the other.
As this involves two (or more) different companies or installations working together, with different processes, procedures and cultures, an effective bridging document is crucial.

The initial work by the CA should be to ensure that the information requirements have been met. Subsequent work should include:

- A scrutiny to ensure that the risk assessment process is valid, and has considered all the possible interactions and major hazard consequences;
- An assessment of the adequacy of the bridging document.

Practical assessment guidance on Combined Operations Notifications is given in Annex 7.

11.4 Other notifications

Directive 2013/30/EU defines two additional categories of post-acceptance notifications:

- Operators/Owners to undertake a **thorough Review** of the RoMH every five years (or less), with the "*results*" of that review to be notified to CA [*Articles 12 (7) & 13 (7)*]. The CA is under no duty to take specific action on receipt of the thorough review results, but these would need to be considered as they could be an indication whether the RoMH is still appropriate and could inform future proactive work.

> ***Article 12 (7)***
> *The report on major hazards for a production installation shall be subject to a thorough periodic review by the operator at least every five years or earlier when so required by the competent authority. The results of the review shall be notified to the competent authority.*

> ***Article 13 (7)***
> *The report on major hazards for a non-production installation shall be subject to a thorough periodic review by the owner at least every five years or earlier when so required by the competent authority. The results of the review shall be notified to the competent authority.*

Key Message:

A Notification of Combined Operations and Well Operations Notification are documents of informative character, and do not require official approval or acceptance from the CA.

Key Message:

The CA shall assure the RoMH is up to date every five years. The review to the RoMH shall be communicated to the operator or owner.

Key Message:

- Weekly monitoring of well operations is important for the CA, in order to react or intervene in the process;
- Monitoring should be carried out by technical specialists;
- Current practice for some CAs (CER-IE) is to demand well operations progress on a daily basis.

- Operators/owners who **intend to dismantle** a fixed installation, which is essentially a sub-category of a "*material change*", should submit an amended RoMH for acceptance.

Article 12 (5)
Where modifications are to be made to the production installation that entail a material change, or it is intended to dismantle a fixed production installation, the operator shall prepare an amended report on major hazards, to be submitted pursuant to point (f) of Article 11(1) by a deadline specified by the competent authority, in accordance with Annex I, Part 6.

Article 13 (4)
Where modifications are to be made to the non- production installation that entail a material change, or it is intended to dismantle a fixed non-production installation, the owner shall prepare an amended report on major hazards, to be submitted pursuant to point (f) of Article 11(1) by a deadline specified by the competent authority, in accordance with Annex I, Part 6, points 1, 2 and 3.

Note. Abandonment of the well is considered to be an operation, thereby related to the Well Operations Notification. Dismantlement of fixed production installations is considered to be a modification, thereby related to the amended RoMH (in case of Material Change).

Table 11.1 summarizes the main activities in the life cycle of an offshore installation and the relevant documents to be submitted to the CA, as required by Directive 2013/30/EU.

Table 11 1 An installation's lifecycle activities and required documentation as per Directive 2013/30/EU

Production Installation			
ACTIVITY		**Type of Notification / Documentation required by the Directive**	**Reference to Directive 2013/30/EU**
Installation planning and design		Design Notification	*Article 11 (1)(3)*
Initial Planned Operations		RoMH	*Article 6 (5)*
Entering MS Waters		Notification of Entering a Member State's Waters	*Article 11 (4)*
Continuing Production		RoMH Thorough Review (every 5 years or earlier)	*Article 12(7)*
Production	Material change: ▪ Modifications on the installation ▪ Operational management changes ▪ Availability of new knowledge and technology	Material change amended RoMH	*Annex I (6)*
	Change of Production Location	Relocation notification	*Article 11(5)*
	Well intervention	Well operation notification	*Article 15 (1) Annex I (4) Annex II*
	Combined Operations	Combined Operation Notification	*Article 16*
Well abandonment		Well Operations Notification	*Article 15 (1) Annex I (4)*
Leaving MS Waters		Notification of Leaving a Member State's Waters	*Article 11 (4)*
Dismantlement of a fixed production installation		Amended RoMH	*Article 12 (6)*

Non-Production Installation			
ACTIVITY		**Type of Notification / Documentation required by the Directive**	**Reference to Directive 2013/30/EU**
Planned Operation		RoMH	*Article 6 (5)*
Entering MS Waters		Notification of Entering a Member State's Waters	*Article 11 (4)*
Continuing Operations		RoMH Thorough Review (every 5 years or earlier)	*Article 13(7)*
Operations	Material change: ▪ Modifications on the installation ▪ Operational management changes ▪ Availability of new knowledge and technology	Material change amended RoMH	*Annex I (6)*
	Well intervention such as drilling , well completion or abandonment	Well Operation Notification	*Article 15 (1) Annex I (4) Annex II*
	Combined Operations	Combined Operation Notification	*Article 16 (1)*
Dismantlement		For a fixed non-production installation only, amended RoMH	*Article 13 (5)*

11.5 Inspection and investigation

Directive 2013/30/EU requires Competent Authorities to oversee compliance with the Directive through inspections, investigations and enforcement actions. Although these regulatory activities are somewhat outside the remit of this report, it is clear that Competent Authorities will need a clear strategy for proactive inspection and investigation work following RoMH acceptance.

In addition to the Directive's requirements, there will inevitably be expectations from the public and offshore workers that the "paper" RoMH, on its own, is not sufficient to secure compliance.

A suggested **proactive** approach for a CA would be one focusing on offshore major hazard risks and implementing a programme of proactive post-acceptance activities to verify that the procedures and processes set out in accepted RoMHs are:

a) consistently applied in practice and;
b) deliver an appropriate control of risk.

Such activities could be a mixture of onshore and offshore intervention activities, targeting installations or owners/operators on a transparent basis, with prioritisation taking into account factors such as relative risk, indications of poor performance, etc.

A suggested **reactive** approach would similarly have a clear strategy/process for investigating incidents, with transparent criteria about which incidents would be investigated by the CA, clarity of what the CA investigation would seek to achieve, and clear consistency in any enforcement decision-making.

CAs will also have a reactive role for responding to complaints about installation safety and/or environmental protection standards, whether anonymous or not.

CAs will need a clear process for responding to such complaints, which incorporates a proportionate approach, fairness in investigation (acknowledging confidentiality, where necessary) and, once again, consistency and openness in enforcement decision-making.

12 Conclusions

In order to ensure a high level of safety in the European offshore oil and gas industry, the EU Parliament and the Council published Directive 2013/30/EU, amending Directive 2004/35, obliging national Competent Authorities to control safety aspects of the offshore oil and gas installations in their waters.

One of the fundamental new requirements of Directive 2013/30/EU is the preparation and submission by owners and operators of a **Report on Major Hazards** (RoMH) for every offshore installation. The RoMH aims at providing evidence that the overall risks from the installation (both to operators and to the environment) have been reduced to an acceptable level.

The training course on the **Assessment of Reports on Major Hazards**: **A focus on the technical aspects of the assessment** was the first course to be held under the Virtual Centre of Offshore Safety Expertise (ViCOS). The course was held on October 13th-14th, 2016 at the JRC premises in Ispra, and it saw the participation of representatives from ten Member States.

The two-day event aimed at providing participants with an understanding of RoMHs technical features, key contents and aspects to be considered during and after the assessment. Each session of the course consisted in presentations followed by group exercises.

The present guidelines summarise the content of the presentations provided during the course, particularly:

- The framework for RoMH assessment, i.e. the types and contents of the RoMH, the assessment and acceptance process;
- Major hazard identification and risk assessment;
- The Safety and Environmental Management System;
- A general assessment of equipment and arrangements, with focus on the assessment of fires and explosions, and of well control aspects;
- The aspects of safety and environmental protection in emergency response;
- The independent verification scheme;
- Post-acceptance issues, such as the assessment of well operations notifications and combined operations notifications;
- Approaches to inspections and accident investigations.

According to the feedback received, the training course was considered by the participants to be successful, well-organized and fruitful. The majority of the participants (63%) believed that it was an excellent course.

The main author and provider of the training course was Mr. Steve Walker, former Head of Offshore Division at UK's Health and Safety Executive, with the valuable contribution of Ms. Myrto Konstantinidou, safety expert at the Demokritos National Centre of Scientific Research.

The JRC is grateful to the training providers for their work in the preparation of the training course and the present guidelines.

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ANNEXES

Annex 1 - Agenda of the Training Course on the Assessment of Reports on Major Hazards

Day 1 - 13th October 2016, JRC Ispra, Italy

08.30-09.00 – Registration & Coffee
09.00-09.30 – Guided Tour of the JRC Visitors' Centre
Session I – **Welcome & Introduction to the course**, Chair: Shlomo Wald (EC -JRC)
09.30-10.00 – **Opening of the Training course**: Welcome by the organizers

- Stefano Tarantola (JRC): Welcome and domestic arrangements;
- Steve Walker: Objectives of the course and outline of the agenda;
- Introduction of the participants

10.00-10.45 – **Scene-setting and recap on Directive 2013/30/EU**

- General requirements of Directive 2013/30/EU (S. Tarantola, JRC).

10.45-11.00 - Coffee/tea break
Session II – **Introduction to Reports on Major Hazards**, Chair: Shlomo Wald (EC – JRC)
11.00-12.45 – **Introduction to how to assess Reports on Major Hazards** (S. Walker)

- Principles of assessment of RoMHs, processes and procedures, and personnel involved;
- General issues when considering RoMH
- Group exercise and feedback from the working groups.

12.45-13.45 –Lunch break
Session III – **Identification of Major Accident Hazards**, Chair: Stefano Tarantola
13.45-15.45 – **Major Hazard identification and Risk Assessment** (M. Konstantinidou)

- Methods and tools for major hazard identification, and risk assessment principles and methodologies;
- Presentation of a case study;
- Group exercise and feedback from the working groups.

15.45-16.00 – Coffee/tea break and feedback from groups
Session IV – **Equipment and Arrangements**, Chair: Stefano Tarantola (EC – JRC)
16.00-18.00 – **Equipment and Arrangements** (S. Walker)

- Assessment of the "Equipment and Arrangements" section of a RoMH;
- Assessment of RoMH sections on: a) Fire and Explosion, b) Well control, and c) Containment of hazardous substances;
- Group exercise to consider a RoMH Case Study, followed by feedback from the working groups.

18:00 – End of the 1st Day

Day 2 - 14th October 2016, JRC Ispra, Italy

Session I – **Emergency Response**, Chair: Shlomo Wald (EC – JRC)
08.45-08.50 – Recap session
08.50-10.40 – **Emergency Response** (S. Walker)

- Assessment of RoMH requirements relating to EER, including the internal ERP and the protection of workers;
- Group exercise to consider a RoMH Case Study, followed by feedback from the working groups.

10.40-10.55 - Coffee/tea break
Session II – **Assessment of Environmental Issues**, Chair: Shlomo Wald (EC – JRC)
10.55-12.30 – **Emergency Response: Environmental Aspects** (M. Konstantinidou, S. Walker)

- Assessment of environmental aspects during emergency response and the EIA;
- RoMH requirements in relation to environmental protection;
- Group exercise to consider a RoMH Case Study, followed by feedback from the working groups.

12.30-13.30 –Lunch break
Session III – **RoMH Management Arrangements**, Chair: Stefano Tarantola (EC – JRC)
13.30-15.00 – **Safety and Environmental Management Systems** (S. Walker)

- Assessment of safety and environmental management systems;
- Safety and Environmental Critical Elements and Verification schemes;
- Group exercise to consider a RoMH Case Study, followed by feedback from the working groups.

Session IV – **After the assessment**, Chair: Stefano Tarantola (EC – JRC)
15.00-15.30 – **Post acceptance issues** (S. Walker)

- How to handle notifications, including those for combined operations & material change;
- Activities to be undertaken by the Competent Authority after the acceptance of a RoMH.

15.30-16.00 – The way forward – Action plan
16:00-16.15 – Wrap up, conclusions
16.15 – End of the Training course

Annex 2 - Checklist on the content of a Report on Major Hazards

PRELIMINARY INFORMATION*		
Type of document:	☐ **Report on Major Hazards**	☐ **Amended Report on Major Hazards*** **
Date of last review / update (if applicable)	__ / __ / ____	
Type of installation:	☐ Production installation	☐ Non-production installation
Status of installation:	☐ New/Planned	☐ Existing
Name of the installation:		
Installation connected with other installations and/or connected infrastructure:		☐ Yes ☐ No
Notifications submitted prior to the RoMH:	☐ Design Notification	☐ Relocation notification
	☐ Not required	

**To clearly define the context of the RoMH.*

Note:

- This checklist has been drafted only for completeness check purposes, to help participants in the identification of the information which should be contained in a Report on Major Hazards, according to Directive 2013/30/EU.
- This document is not an assessment checklist.
- The list of information may not be exhaustive and its use is not an official EU requirement.

Note:

- Some of the descriptions to be required according to this checklist might somehow overlap. The purpose of the checklist, however, is to spot any missing information as required by Directive 2013/30/EU.

ANNEX 2
CHECKLIST ON THE CONTENT OF A REPORT ON MAJOR HAZARDS

SECTION A. GENERAL INFORMATION				
	DOES THE REPORT CONTAIN THE FOLLOWING INFORMATION (AS PER DIRECTIVE 2013/30/EU)?	*CORRESPONDING SECTION(S) IN THE ANALYSED DOCUMENT*	*IS IT EXHAUSTIVE?*	*MISSING / INCOMPLETE INFORMATION (TO BE ASKED AS INTEGRATION (ART. 12(4))*
☐	Name of the Operator (*For production installations only)*	*E.g. Chapter 1.5*	☐ Yes ☐ No	*(if section is considered <u>not</u> exhaustive)*
☐	Name of the Owner (*For non-production installations only*)		☐ Yes ☐ No	
☐	Address of the Operator (*For production installations only)*		☐ Yes ☐ No	
☐	Address of the Owner (*For non-production installations only)*		☐ Yes ☐ No	
☐	Description of account taken of the CA response to the design / relocation notification (*For production installations only*)		☐ Yes ☐ No	
☐	Description of the installation (including means of transfer and stationing – *in case of non-production installations*)		☐ Yes ☐ No	
☐	Description of any association of the installations with other installations or connected infrastructure (including wells) (*For production installations only*)		☐ Yes ☐ No	
☐	Summary of workers involvement in the preparation of the Report on Major Hazards		☐ Yes ☐ No	
☐	Reference to the relevant codes, standards and guidance used in the construction and commissioning of the installation		☐ Yes ☐ No	

SECTION B. MAJOR HAZARD IDENTIFICATION & ASSESSMENT				
	DOES THE REPORT CONTAIN THE FOLLOWING INFORMATION (AS PER DIRECTIVE 2013/30/EU)?	*CORRESPONDING SECTION(S) IN THE ANALYSED DOCUMENT*	*IS IT EXHAUSTIVE?*	*MISSING / INCOMPLETE INFORMATION (TO BE ASKED AS INTEGRATION (ART. 12(4))*
☐	Demonstration that all **major hazards** have been **identified**	*E.g. Chapter 1.5*	☐ Yes ☐ No	*(if section is considered <u>not</u> exhaustive)*
☐	Demonstration of major hazards **likelihood** and **consequence** assessment (taking into account also any environmental, meteorological, seabed limitations on safe operations)		☐ Yes ☐ No	
☐	Description of all **types of operations** with major hazard potential to be carried out on the installation (including the maximum number of PoB the installation at any time)		☐ Yes ☐ No	
☐	Demonstration of **suitability of MAH control measures** and safety and environmental critical elements in place to reduce the risk of a major accident to an acceptable level		☐ Yes ☐ No	
☐	Assessment of **Oil spill response effectiveness**		☐ Yes ☐ No	
☐	Demonstration of the identification of all major hazards for all operations the installation is capable of performing (*for non-production installations)*		☐ Yes ☐ No	
☐	Demonstration that the risk of a major accident is reduced to an acceptable level – refer to point above (*for non-production installations)*		☐ Yes ☐ No	

	SECTION C. DESCRIPTION OF CONTROL MEASURES			
	DOES THE REPORT CONTAIN THE FOLLOWING INFORMATION (AS PER DIRECTIVE 2013/30/EU)?	*CORRESPONDING SECTION(S) IN THE ANALYSED DOCUMENT*	*IS IT EXHAUSTIVE?*	*MISSING / INCOMPLETE INFORMATION (TO BE ASKED AS INTEGRATION (ART. 12(4))*
	DESCRIPTION OF EQUIPMENT AND ARRANGEMENTS:			
☐	Description of equipment and arrangements to ensure **well control**	*E.g. Chapter 1.5*	☐ Yes ☐ No	*(if section is considered <u>not</u> exhaustive)*
☐	Description of equipment and arrangements to ensure **process safety**		☐ Yes ☐ No	
☐	Description of equipment and arrangements to ensure **fire & explosion prevention**		☐ Yes ☐ No	
☐	Description of equipment and arrangements to ensure **containment of – and protection of workers from - hazardous substances**		☐ Yes ☐ No	
☐	Description of equipment and arrangements to ensure **protection of the environment from an incipient major accident**		☐ Yes ☐ No	
	DESCRIPTION OF EQUIPMENT AND ARRANGEMENTS FOR PROTECTION OF PERSONS/WORKERS:			
☐	Description of equipment and arrangements to **protect persons on the installation from major hazards**		☐ Yes ☐ No	
☐	Description of arrangements to ensure **safe escape** of persons on the installation		☐ Yes ☐ No	
☐	Description of arrangements to ensure **safe evacuation and rescue** of persons on the installation		☐ Yes ☐ No	
☐	Description of arrangements for the **maintenance of control systems in the event that all personnel are evacuated** (to prevent damage to the installation and the environment)		☐ Yes ☐ No	
	SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM:			
☐	Adequate description of the **Safety and Environmental Management System** of the operator (all information relevant to *production/non-production installation*s)		☐ Yes ☐ No	

Annex 3 – Guidelines for Competent Authorities during the assessment of major hazard identification and risk assessment aspects of RoMHs

MAJOR HAZARD IDENTIFICATION AND RISK ASSESSMENT PROCESS IN THE RoMH	
Topics	**Some key assessment issues**
1. Overall compliance with the Directive	▪ Taken as a whole, does the RoMH provide a clear demonstration that a logical and appropriate process has been undertaken to: o identify all the major hazards o assess the likelihood and consequences of those major hazards o ensure that the proposed control measures are suitable and reduce the risk of a major accident to an acceptable level
2. Hazard identification	▪ Is the methodology for undertaking the hazard identification clear? ▪ What overall guidelines or standards have been used? Are they appropriate? ▪ Which hazard identification techniques were used? Can the operator/owner justify why they have used these techniques? Are these appropriate? ▪ What evidence is there that the hazard identification techniques been conducted professionally and correctly? Were the teams suitable and experienced, especially the leaders of HAZID and HAZOP exercises? ▪ Has the workforce been effectively involved in the range of hazard identification exercises? ▪ How did the operator/owner ensure that the hazard identification studies covered the whole range of operations likely on the installation?
3. Risk assessment	▪ Is the whole process for establishing risk levels clear? ▪ Is the overall approach appropriate for the size/complexity of the installation? (e.g. qualitative v semi-quantitative v QRA) ▪ Is there a clear link between the hazard identification and the risk assessment? ▪ Undertake a Competent Authority "reality check" - do the results of the risk assessment seem sensible? ▪ If consultants were used to undertake this risk assessment work: o Does the scope of their work match the range of hazards on the installation? o Is there evidence that the operator/owner has provided the consultants with all appropriate information (for instance Piping & Instrumentation Diagrams, access to company specialists etc.)? o Is the consultant experienced in this type of work? Does he/she have the necessary knowledge for the installation involved?
4. Consequence estimation	▪ Is the process for identifying the consequences of major hazards clear? ▪ Is the range of detailed consequence/escalation studies appropriate for the hazards? ▪ If consultants have undertaken such studies, consider same range of question as per risk assessment above
5. Control and mitigation measures	▪ Is it clear how the major hazard control measures on the installation have been influenced by the hazard identification and risk assessment process? ▪ Do any of the risk/consequence studies recommend additional controls to further reduce risk? Have these recommendations been implemented, and if not, why? ▪ How has the operator/owner demonstrated that the control measures have reduced the risk to an acceptable level?

At any point, if the process or the methodology used is not clear or completely rationale ask for details and clarifications.

Annex 4 - CMAPP Checklist

CMAPP CHECKLIST			
Does the Corporate Major Accident Prevention Policy contain explicitly written reference on the following aspects?	**YES**	**NO**	**Comments / Reference in the text**
(1) the responsibility at corporate board level for ensuring, on a continuous basis, that the corporate major accident prevention policy is suitable, implemented, and operating as intended; There should be an emphasis on the continuous nature of this responsibility, including arrangements for Board level monitoring of the effectiveness of the CMAPP, and for rectifying any shortfalls			
(2) measures for building and maintaining a strong safety culture with a high likelihood of continuous safe operation; For instance, effective consultation with the workforce, Board level support for initiatives, strong Board commitment, and overall safety leadership for major hazard management.			
(3) the extent and intensity of process auditing; The details of the broad corporate auditing process, should include issues such as periodicity, competence of auditing, how findings are reported and improvements tracked, role of Board in monitoring the company audit process (including when the Board is involved in significant concerns).			
(4) measures for rewarding and recognising desired behaviours; Measures to enhance motivation and safe behaviour should be described in this part.			
(5) the evaluation of the company's capabilities and goals; This evaluation of the company's capabilities and goals are with respect to major hazard control and management, and the need for periodic high level review.			
(6) measures for maintenance of safety and environmental protection standards as a corporate core value; The CMAPP should show how the Board understands the company's safety/environmental standards/objectives, and how they are support and recognise this.			
(7) **formal command** and **control systems** that include board members and senior management of the company; For the purposes of the CMAPP, this should cover, at the minimum, how the Board maintains an oversight and involvement in operational activities which are relevant to the MH risks, so is not just restricted to major hazards incident response.			

(8) the approach to **competency at all levels** of the company; This can reference out to any company-wide competency systems, but should include the Board's approach to ensuring competency relevant to MH management and control, including contractors working on their installations and premises.			
(9) The extent to which particulars (1)-(8) are applied in the company's offshore oil and gas operations conducted outside the Union.			

Annex 5 - Assessment of Core SEMS Management procedures in the RoMH

ASSESSMENT OF CORE SEMS MANAGEMENT PROCEDURES IN THE RoMH	
Broad description	**Some key assessment issues**
1. Competency and Training	1. Is the process for initial suitability and first employment clearly described? Does it cover the following? ▪ Selection ▪ Pre-employment medical ▪ Induction process ▪ Basic offshore competencies such as survival training and emergency response actions 2. How are safety critical tasks, and their competency requirements, identified? 3. Are training matrices used? Are they comprehensive? 4. Are the training and competency requirements for specific operational roles, including emergency response staff, clearly defined? Do these arise from a clear and comprehensive process? 5. Is the competency assessment and record process well documented and adequate? 6. Have human and organisational factors influenced the competency and training process? How has that been done?
2. Control of Contractors, Procurement Management, and working with third parties	1. Are the arrangements for the selection of contractors or companies who supply goods and services clear? Do they provide an adequate system for assessing safety critical issues such as quality control of supplied equipment, competence of staff, etc.? 2. Are contractor or vender personnel who work offshore included within the operator/owner SEMS? How is this done? 3. If SIMOPS or combined operations are relevant to the installation: ▪ are there comprehensive SIMOPS/combined operations procedures? ▪ do those procedures include a review process to identify any additional or changed risks created by the combined operation, and their consequences? ▪ is the bridging document process adequate? Does it provide evidence of the need to identify agreed management processes and clarity of decision making? Are the agreed working procedures for the combined operation clear (especially major hazard control procedures and decision-making)? Is there a summary of the proposed arrangements for coordinating the management systems of the two installations involved?
3. Management of Change	1. Is there a comprehensive description of Management of Change (MoC) process? 2. Are the MoC procedures clear, with defined roles and responsibilities? 3. Is it clear how (and by whom) the MoC procedures are triggered? 4. Does the MoC process involve an assessment of the hazard/risk of the proposed change? Is it adequate?

4. Permit to Work system	1. Is the Permit to Work process well described? 2. What standards or guidelines is the process based on? Are these appropriate? Do the isolation procedures follow recognised practise? 2. Is its scope sufficient for the installation? 3. Are roles and responsivities clear? 5. Are training requirements identified? 4. Is there an effective management and review system for the PTW system?
5. Logistics	1. Does the RoMH describe comprehensive Helicopter Operations procedures/Manuals? Is there evidence that these meet industry/regulator guidelines? 2. Are there comprehensive helideck procedures, including allocation of roles, training (especially Helicopter Landing Officers), and covering both routine and emergency helicopter operations? 3. Are there comprehensive maintenance arrangements for the helideck and associated helicopter operations equipment 4. Have the activities of standby and supply vessels been assessed with respect to major hazards? Are the results of such an assessment reflected in the support vessel arrangements? 5. Does the installation have a clear adverse weather procedure? Are those arrangements and any weather limitations appropriate?
6. Independent Verification	1. Are all the specific Directive requirements included in the description of the independent Verification Scheme, 2. Is there a clear, comprehensive summary of the Independent Verification system, linking out to more detailed documents (for separate, more detailed, assessment)? 3. Is the scope of verification activity (such as initial design and commissioning, during projects, delivering SECE performance testing etc.) reflected in the management arrangements? 4. Are roles and responsibilities for the verification systems detailed and adequate? 5. Is there clarity of how the SECEs and their performance standards are identified from the installation major hazard risk identification/assessment process? Is the approach systematic? 6. Is the approach to identify the range, scope and periodicity of the verification activities, for both active and passive SECEs, clearly described? Are they appropriate? 7. Does the SEMS include details of how the results of the verification will be used? Is there an escalation process when the verification findings cannot be resolved? How are the results of SECE performance testing monitored by senior management? 8. Are the Annex V requirements for the selection of the independent verifier fulfilled? 9. If the installation is also a vessel, are the Verification and Classification activities well-coordinated? 10. Is the introduction of 3rd party and contractor SECEs covered? Are the proposals suitable?

7. Overall HS &E procedures	1. Is it clear how the overall health, safety and environmental protection will be managed, with clear expectations and roles throughout the management chain? 2. Is it clear how safe working practises will be developed and implemented? What are the pre-task arrangements – do they include task risk assessment? Tool box talks or other communication methods? Is the "Stop Job" process clear and established? 3. Are occupational health issues reflected in the HS&E management procedures? Does this include such core issues as legionella, radioactive materials and H_2S? What about PPE selection and training? 4. Are more detailed procedures available for further assessment if required? 5. Is the process of incorporating environmental protection management into H&SE systems/procedures clear? Are the spill and general waste management systems and procedures adequate?
8. Process for identifying and evaluating major hazards, and their likelihood/ and potential consequences	1. Are the processes for identifying and evaluating MH risk, and their consequences, clear? 2. Are environmental impact and consequence issues integrated into these procedures? 3. Is the process adequate and comprehensive? e.g. those involved, breadth of techniques used, 4. What quality checks are integrated into the risk assessment process? 5. How do the outcomes of this process link into the development of MH procedures and controls?
9. Other more specific procedures, such as: ▪ **emergency response** ▪ **drilling and well control** ▪ **process operations** ▪ **marine operations** ▪ **lifting operations** ▪ **the maintenance process** ▪ **continuing structural suitability** ▪ **lifting operations**	1. Assess whether the management systems are clear and adequate for the installation concerned. 2. Ascertain the standards or guidelines upon which the respective procedures have been developed. Are they suitable? 3. An assessment of both the management systems which support these procedures, and a detailed scrutiny of the procedures themselves, is appropriate for these broad topics (see previous sessions regarding emergency response and well control).

Annex 6 - Assessing Environmental Response

ASSESSMENT OF ENVIRONMENTAL RESPONSE ISSUES IN THE RoMH	
Broad Topics	**Some key assessment issues**
The management of the environmental response arrangements	Are the command and control arrangements for an environmental emergency response clear? Do these arrangements cover the following: ▪ The identification of who is responsible for the initiation of the installation environmental response actions ▪ Clarity of respective roles of the company's offshore and onshore management ▪ Clear statement of responsibility for notifying external emergency response arrangements, and on-going liaison on environmental response and containment issue o This would include any senior company representatives and/or technical specialists attending the External Emergency Response control centres
Emergency Response Contractors	▪ Is the activation process for mobilising environmental response contractors (e.g. vessels to deploy booms and skimmers and contractors to clean beaches) clear and comprehensive? ▪ How are those contractors to be coordinated? ▪ Is there a demonstration that the environmental response contractors have the capacity and capability to undertake this work? What is the time necessary to deploy these contractors? Is that time suitable, bearing in mind the anticipated modelling of the spill development? ▪ If the oil spill modelling indicates that beaching of the oil is a possibility, is the mobilisation time for the beach response contractor adequate to provide an effective response to minimise the impact of oil pollution?
Oil spill response equipment	▪ Is there an inventory of the oil spill response equipment? ▪ Is the ownership and storage location of this equipment clearly stated? ▪ What are the arrangements for ensuring that the equipment is maintained in an operable condition? ▪ What are the arrangements for transporting oil spill response equipment to the deployment location? Would they be sufficient in the case of a foreseeable oil spill? ▪ What are the arrangements for ensuring that the procedures for using the oil spill response equipment are maintained in an operable condition?
Use of Dispersants	▪ What is the evidence that any available dispersants been assessed or approved to minimise the risk of long term environmental damage or to the food chain ▪ How has the dispersant been chosen to reflect the possible oil types that could be released? Have any limits to the dispersant efficacy been identified, and if so what are the consequences?
Training	▪ Are the arrangements for training those involved in environmental emergency response adequate? ▪ Are the requirements for environmental response drills and exercises (including "desk top" exercises) clear?

Environmental response strategies	▪ Does the Internal Environmental Response Plan clearly describe the range of response strategies which should be adopted? ▪ Do those strategies include adequate details of o Dispersants; o Containment (booms) o Recovery (mechanical skimming etc.) o Monitoring and surveillance (including aircraft and satellite) o Where appropriate, controlling the well source via subsea isolation, well capping, well kill, or relief well drilling ▪ To aid environmental response, how will any oil spill volumes be calculated? What access does the operator/owner have to real-time oil spill modelling in the event of a release to sea? Are these arrangements satisfactory?
Capping devices	▪ Does the RoMH identify whether the use of well capping devices is appropriate? ▪ If so, what is the procedure for assessing what type of capping device is required, and whether it would be compatible to the well infrastructure and anticipated well pressures? ▪ What is the anticipated time from mobilising the well capping device to finally successfully capping well? Which contractor would be doing this?
Relief Wells	▪ How is the need for a relief well considered? ▪ If a relief well is to be an option (following a specific well notification), what are the requirements, and what is an estimate of the time needed to complete the relief well operation (from the day the relief well operation is mobilised to the actual well kill via the relief well) ▪ If a relief well is an option, what is the availably of a suitable drilling rig during the period of the well operation? What pre-contract arrangements are in place for securing the relief well rig?
Knowledge of any particular environmental sensibilities	▪ Does the RoMH contain an assessment of the potential overall environmental effects of a spill? ▪ Are any specific environmental sensitivities stated in the RoMH or ERP? How are they factored into the environmental emergency response plan?
Effectiveness of oil spill response	▪ Is there an analysis of the likely effectiveness of the oil spill response? ▪ Does the analysis include considerations of o Weather (wind, visibility, rain/snow, ad temperature) o Sea states, including tides and currents o Hours of daylight o Presence of ice and debris o And other known environmental conditions which could affect the effectiveness of the response
Link to External Emergency Response Plans	▪ Does the RoMH adequately describe how the operator/owner's internal response procedures for environmental response link to any relevant wider External Emergency Response Plans?

Annex 7 - Assessing Combined Operations Notifications

ASSESSING COMBINED OPERATIONS NOTIFICATIONS

Some practical issues

1. From an initial quick scrutiny, ensure that the original combined operations notification provides all the information required by the Directive, including:

- A clear agreement that all the parties in the combined operation agree with the contents of the notification
- A clear description of the actual operation, and the programme for this work
- Description of any equipment which is to be used in the combined operation and which is not described in the current RoMHs for either installation
- A bridging document, authorised by all the parties, which sets out how the management systems of the two installations will be coordinated
- A summary of the risk assessment, including specifically:
    a) A description of any operation during the combined operations programme which has the potential to cause a major accident
    b) A description of any risk control measures which are introduced as a result of the risk assessment

If the notification does not cover all these specific issues (and any other issues specifically required by your own legislation), return the notification and "re-set" the deadline for your CA response.

2. Remember that the combined operations notification is in addition to the normal RoMH arrangements for the two installations involved. Therefore, the scrutiny of the combined operations notification should focus on the interactions between the two installations, issues over and above the individual RoMHs. However, the RoMHs for the two installations involved (which will have already been accepted by your CA) will be essential reference documents during this work. The notification supplements the generic combined operation arrangements of the RoMH.

3. A large percentage of combined operations will also involve a well operations notification. Ensure your scrutiny system of the two linked notifications is well coordinated, with good communication between the two teams to ensure each is aware of emerging issues and progress of the others' scrutiny. In particular, some of the technical detail about the well operation will be essential background for the scrutiny of the combined operation notification (e.g. whether the well is HPHT, likely presence of H2S, the identification of any meteorological or seabed limitations, the extent of the well programme itself etc.).

4. Key areas for assessment of the combined operations notification include:

Risk assessment

a) What is the quality and thoroughness of the risk assessment work done for the combined operation programme? Has a systematic approach been adopted to assess the risk impact of the joint operation? Does the risk assessment cover the whole life cycle of the combined operations? This is not just a re-run of the risk assessments undertaken within the respective RoMHs, but will include the identification of the additional risks (or increases to existing risks) that the combined operation will cause to either installation.
b) Have site specific issues been taken into account during the risk assessment and the selection of controls? Examples could include structural loadings (such as loading from additional temporary equipment or the interaction of MODU spud cans on installation piles or subsea furniture), any

restrictions during the combined operation (such as vulnerable topside structures or sea state limits), and increase in marine activity (e.g. anchor handling operations)

Management arrangements

a) Are the anticipated management arrangements for combined operations, as laid down in the respective RoMHs, being followed? If not, why not and what are the consequences?
b) How was the bridging document arrived at? Was it the result of a formal GAP analysis of the SEMS and procedures between the two installations, or does it just follow a "standard" format10? Is it comprehensive?
c) When the combined operations concerns well operations, is it is absolutely clear whose well control manual take precedence? Is this liable to cause competency problems on either installation?
d) Are the overall decision, command and control arrangements described, and appropriate?
e) Have the interface arrangements been tested before the combined operation commences? For instance, a Drilling the Well on Paper exercise (DWOP) is a common practise to test interface arrangements prior to a combined operations starting.
f) How are third party contractors included in the interfacing arrangements?
g) What is the induction process for staff/contractors working on the other's installation?

Emergency response

a) Has the need for any changes in the emergency response arrangements been considered? Is the layout, availability and capacity of emergency evacuation and escape still appropriate for the two installations working in combination? Are any of the existing escape routes or equipment compromised? Has any increase in the numbers on board been taken into account?
b) Has the internal emergency response plans of both installations been assessed and amended to take into account the combined operation? Has that of the non-production installation been submitted with the combined operations notification? Have the oil spill response/effectiveness of both installations been updated to take into account the specific nature of the combined operations?

[10] There has been pressure from industry to use more standard templates for bridging documents.

Annex 8 – Case Study: Equipment and Arrangements

REGAL DRILLING INC.

RoMH for "DRILL KING" MODU.

3. **DRILLING & WELL CONTROL**

3.1. Introduction

3.1.1 The Drill King rig is a deep water drilling semi-submersible rig of the Yutson class, built by Yutson Shipbuilders of South Korea in 1990. It is capable of 30,000 ft. drilling depth and operation in 7,000 ft. water depth. It has a standard drill floor layout and equipment, similar to all other rigs of the Yutson class, with rotary table etc., and the Driller's cabin overlooks the drill floor.

3.1.2 All drilling equipment on the Drill King described complies with the MODU Code, Class Rules and the relevant API codes. It is approved by the Classification Society. The equipment is maintained and tested by Regal Drilling through the rig's planned maintenance process, with third party inspections and tests occasionally requested by Regal Drilling as appropriate.

3.2. Hoisting & Pipe-handling

3.2 .1 The derrick is a conventional type, with a free lifting height of 150ft. Hook load capacity of 1,250,000 lb., and the associated equipment includes 330 stands (300,000 ft.) of drill pipe. The pipe handling systems are able to handle both vertical and horizontal tubulars, using the two 85t hydraulic boom cranes adjacent to the drill floor.

3.2.2 The derrick has a hydraulic stabbing basket installed in the derrick. All functions, including emergency, are controlled from the basket, which also has an escape line for emergency escape. A remote control panel for the basket is on the drill floor. The stabbing basket has a 225 kg safe working load. In addition, two dedicated man-rider winches are provided, one port and one starboard side of the drill floor. Two man-rider winches are also provided, one forward and one aft, on the BOP deck. A training matrix is available for the rig which indicates those personnel, in addition to the Crane Operators, that have received training in the lifting related courses such as Man Riding Operations, Working at Heights, and Rigging.

3.2.3 An iron roughneck "Hydra Tong MPT 200" is installed on the drill floor, and is a safer method of handling drill pipe than manual tongs. The iron roughneck is designed to spin in/torque up and brake out/spin out tubulars from 3 ½" to 9 ¾ "diameter, and casing up to 25" diameter. The Hydra Tong system consists of a travelling elevation frame onto which the specific tool frames for handling different sizes of tubular can be hung. The tool frames are brought to and from the Hydra Tong MPT using winches. The Hydra Tong MPT travels to and from the well centre on rails. All functions are electro/hydraulic remotely operated, controlled from the drill-floor electronic operating system. Two hydraulic catheads are used to provide a line pull for the rig tongs. The hydraulic catheads are remotely operated, but can also be operated from the local control panel on drill floor.

3.2.3 Drill King has a Majestic 60-50 rotary table which has a light opening of 60" (with adapter bushing 60" to 49.5"). The rotary table is equipped with hydraulic drive motors (not for drilling) with sufficient capacity to rotate the drill string slowly during pipe connections. It is operated from the Driller's cabin.

Static Load Rating: 1,100 tonnes

Max. Recommended Table Speed: 140 rpm
Max. Torque at 100 rpm: 77.3 kNm

The table drive motors are powered via a hydraulic fluid ring main line energised via the HPU which supplies hydraulic fluid at 207 bar. The HPU includes four pumps, with pump displacement regulated by a hydraulic pressure control valve. The high pressure sides of the pumps are equipped with individual pressure relief valves to limit maximum running pressure of the pumps. The pumps are separated by a check valve to ensure back up in case of a pump failure. The HPU is fitted with an effective cooling and filtration system. The hydraulic oil reservoir is fitted with a heater.

3.2.4 The marine riser tensioning system is installed to keep positive tension in the marine riser and compensates for the heave (vertical relative motion) between the riser and the rig during drilling. The WRTS has a maximum tension capacity of 2,000,000lbs with a compensating stroke of 19.05m – four times the cylinder stroke. The WRTS controls the tension in the riser by means of six dual wireline tensioners, installed in diametrically opposed pairs around the riser, outside the derrick at drill floor level. The riser is suspended by support wires that are routed from the riser support ring to the tension cylinders via idler sheaves. The cylinders have wire sheaves at both ends and the wires are reeved around the cylinder sheaves to give a 4:1 mechanical advantage. The cylinder end of each wire is terminated in a wire anchor. Each riser tensioner is fitted with one high pressure and one low pressure accumulator. The riser tensioners maintain tension in the wire ropes by taking up or paying out rope in response to rig motion. As downward heave of the rig tends to cause a decrease in rope tension, the hydraulic pressure in the cylinder causes the cylinder to extend to maintain the selected rope tension. HP air is supplied from the APV's to the high-pressure accumulator to maintain hydraulic pressure in the tensioner cylinder.. As upward heave of the rig tends to cause an increase in rope tension, the cylinder retracts, increasing the length of wire rope, to maintain the selected rope tension. When the cylinder retracts, fluid in the tensioner cylinder passes through the riser anti-recoil valve into the fluid side of the high-pressure accumulator and air in the accumulator will be compressed into the APV's. The WRTS includes an air valve control skid 24 x working APV's, 6 x standby APV's, a control cabinet with the PLC, and a local operating panel. The WRTS can be operated by controls in Driller's cabin or from a local panel.

3.3. Mud & Cement System

3.3.1 There are eight pressure bulk silos on the rig for bulk storage of barite, bentonite and cement. Two cylindrical tanks (P-tanks) are installed in each of the large diameter columns extending through the decks 3 to 5. Two additional tanks can be used for displacing riser mud volume or as excess mud storage. There are two pill tanks and a slug tank, which are used for mixing pre-trip slugs and/or premixes. Each mud pit is filled/circulated via three centrifugal mixing/ transfer pumps and two mixing hoppers. The drilling fluid (mud) is pumped from the active mud pit by the main mud pumps, situated forward of mud pits. These pumps are pre-charged by mud charge pumps on the low pressure side.

3.3.2 The mud system is operated and monitored, when drilling, locally in the Shaker Room and the Mud Pump Room. It is also controlled remotely from the Driller's cabin by the Driller. The system is additionally monitored in the mud logging unit. The key safety aspects of the mud system on the rig is: -

- All high-pressure mud lines and manifolds have thickness check surveys carried out on a periodic basis. This is included in the rig's Planned Maintenance System, and reviewed by a third party (DNV).
- The safety relief valves are tested and re-dressed as necessary by an authorised company. All valves and sensors on the mud pump, rig floor manifolds and top drive are pressure tested on a regular basis either to 300 psi low and 7,500 psi high, or according to operator requirements. All the above is part of the rig's Planned Maintenance System.

3.3.3 During normal drilling operations sufficient stocks of barite etc. are maintained to effect well control operations. The company guidelines for minimum Barite stock levels are below:-

Minimum Stock of Barite - Tonnes					
Mud Wt		**Gradient**		**Volume of Total Active System (BBLS)**	
ppg	**psi/ft**	**1000**	**1500**	**2000**	**2500**
8.0	0.416	53	80	107	133
8.5	0.442	54	82	109	136
9.0	0.468	56	83	111	139
9.5	0.494	57	85	114	142
10.0	0.520	58	87	116	145
10.5	0.546	59	89	119	148
11.0	0.572	61	91	121	152
11.5	0.598	62	93	124	155
12.0	0.624	64	95	127	159
12.5	0.650	65	98	130	163
13.0	0.676	67	100	133	167
13.5	0.702	68	103	137	171
14.0	0.728	70	105	140	176
14.5	0.754	72	108	144	180
15.0	0.780	74	111	148	185
15.5	0.806	76	114	153	191
16.0	0.832	78	118	157	196

3.4. BOP Systems

3.4.1 The BOP is designed to be able to close off the wellbore or around tubular and to provide means of holding and circulating pressures up to 15,000 psi. It is designed and maintained to API standards. Should the BOP be used for HP/HT service, relevant BOP components would be upgraded with elastomeric compounds.

3.4.2 The BOP overhead crane is designed as a conventional gantry crane, running port/starboard. The crane is equipped with two fixed main winches of 145t SWL each (N.B. winches rated by manufacturer's at 155t each but overload test carried out to 145t SWL), designed for lifting the BOP stack. The main winch hook blocks are each terminated with a single lifting pin designed specifically to interface with lifting pad-eyes incorporated within the BOP stack frame. The crane is also equipped with two travelling auxiliary winches, each of 30t SWL, used for various maintenance and operational procedures. The auxiliary winches are mounted on the port and starboard edges of the main beam and travelling in the forward/aft direction. The two main winches and the two auxiliary winches are driven by hydraulically powered (variable speed) gear units. Hydraulic power is supplied from the high pressure rig hydraulic ring line.

3.4.3 The Cameron BOP stack has flexible arrangements for its configuration, depending upon client preferences and the reservoir characteristics. Regel Drilling prefers to use a combination of an annular preventer, blind and casing sheer rams variable bore pipe rams, along with a Vetco wellhead connecter. The annular BOP is hydraulically operated and will close and seal off on drillpipe, tool joints, tubing, casing, or wireline in the wellbore or completely seal off the open hole to full rated pressure.

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3.4.4 The Drill King BOP is fitted with a BOP and LMRP Control System capable of operating in water depths up to 6000 ft. The system is supplied with two subsea control pods (yellow and blue) and either pod can control the subsea BOP, LMRP and associated subsea ancillary equipment. Subsea control components

are duplicated to provide redundancy. The control pod contains hydraulic control valves which, on command from the surface (from either the driller and toolpusher panels), direct the flow of hydraulic power fluid to and from the blowout preventers, hydraulic connectors and valves, etc. The ROV panels on the lower stack and LMRP will be updated in Q1 2017. The rig is also fitted with a Deadman Auto shear system.

3.4.5 A diverter system is installed for safe venting any shallow formation gas encountered in top hole drilling and any gas accumulation in the marine riser. The diverter functions are hydraulically actuated and operated remotely from the driller's and toolpusher's panels. The pressure rating is 500 psi although the diverter system is not designed as a pressure retaining system but rather for flow diversion. The diverter has connections for one diverter line, one flow line, one fill up line and hydraulic control lines.

3.4.6 The choke and kill system is used to depressurise well influxes during circulation of the well bore by routing to the poor boy degasser or overboard to opposite sides of the rig. The choke and kill lines are an integral part of the blow out prevention equipment required for drilling well control. The choke and kill manifold has a rated working pressure of 12,000 psi and has two manual and two remotely operated chokes. The remotely operated chokes are controlled from the Driller's cabin and from the local control panel close to the choke and kill manifold on the drill floor. The kill line provides a means of pumping fluid into the well bore when normal circulation through the drill string cannot be employed. The choke line connected to the manifold provides a means of applying back pressure on the formation while circulating out formation fluids influx into the well bore following a "kick" which is an entry of water, gas, oil or other formation fluid into the well bore resulting from insufficient pressure from the drilling fluid column to overcome the pressure exerted by the well formation. Failure to control a "kick" would result in a "blow out" or uncontrolled release of formation fluids or gases.

3.4.7 The BOP and all its components are maintained to pressure tested to clients' requirements on a regular basis. Pressure tests, for example, would be carried out following casing runs. All rams, annular preventers and valves are individually tested to the required test pressure using the cementing unit. At the end of each well, the BOP is inspected for damage, and subsequently tested.

3.4.8 Normal well operations are managed as indicated in the Organisation Chart, and all drilling operations are carried out according to Regal Drilling well control procedures.

Annex 9 – Case Study: Emergency Response – Safety Aspects

REGAL DRILLING INC.
RoMH for "DRILL KING" MODU.

7.1 GENERAL

7.1.1 Guidance regarding to the emergency response on Drill King includes:

- The Emergency Response Plan (ERP);
- Station Bill;
- Drill King Operations Manual.

The Offshore Installation Manager's (OIM) is the person in charge of the Drill King, and has a duty to ensure that all personnel are aware of and comply with the procedures documented within the ERP. As such, every person new to the Drill King undergoes an orientation tour as part of the induction process which, amongst other things, explains where to find the Station Bill and other information regarding emergency response. The induction process is supported by a 30 minute video on actions for all general personnel to take upon the operation of the Drill King General Alarm, and formal "Muster Station" drills are held weekly.

7.1.2 In order to ensure appropriate arrangements for evacuation, escape, recovery and rescue, the following have been considered:

- all foreseeable major accident scenarios which may require evacuation, escape and rescue from the Drill King and an assessment of the likelihood of them occurring;
- the arrangements which would be available in the event of a major accident requiring evacuation, escape and rescue from the Drill King;
- the performance of the arrangements in the event of a major accident, taking into account factors which might affect their performance;
- the availability of the following:
    - escape routes from each working area such that, in the event of an accident scenario, persons not immediately affected can make their way to the Temporary Refuge (TR), and respective muster areas;
    - a TR from which safe and complete evacuation and rescue can be planned and carried out;
    - embarkation, evacuation and rescue capability which will have a high level of availability taking into account environmental conditions.

7.1.3 The Drill King emergency response procedures are under continuous review as a result of safety/environmental meetings, weekly drills and audits.

7.2 EMERGENCY RESPONSE ANALYSIS

7.2.1 The Drill King evacuation arrangements include:

- escape routes from work stations to muster areas
- primary and secondary muster areas and temporary refuge
- areas used for refuge temporarily
- protected routes from muster/temporary refuge areas to embarkation points
- embarkation points
- evacuation and escape equipment.

7.2.2 Performance standards for each of the above elements have been set in accordance with the management system requirements relating to managing risk. Full details are in the ERP.

7.3 EMERGENCY RESPONSE PLAN

7.3.1 The Drill King Emergency Response Plan (ERP) contains the details of the planned response to an emergency. The ERP provides the general guidelines to be followed in the event of the occurrence of an incident with the potential to endanger life, property or the environment. Actions to be taken are also detailed on the MODU's Station Bill, copies of which are posted conspicuously around the MODU.

7.3.2 The ERP provides guidance to the OIM and MODU crew about the arrangements that should come into effect and the procedures to be followed by the appropriate personnel in the event an emergency occurs on the MODU. The ERP contains:

- organisation details
- roles and responsibilities
- communication arrangements
- emergency signals and drills
- contact details
- reporting requirements.

7.3.3 In addition, the overall process of dealing with emergencies is presented in flow charts that have been used as a basis for developing a suite of the emergency procedures. The flowcharts are based on the following scenarios, which have all been identified through the Drill King major accident identification process, including:

- fire/explosion
- collision
- flooding and damage control
- helicopter crash on Drill King
- helicopter crash near Drill King
- search and rescue
- evacuation/abandon ship
- lack of well control, or conditions which could lead to such
- H_2S
- ballast emergency
- structural failure
- heavy weather
- hull leakage
- responding to oil spill to sea.

7.3.4 The flow charts illustrate the overall process for dealing with emergencies including an outline of the procedures associated with responding to initiating events with the potential to escalate into a major accident.

7.4 COMMAND AND SUPPORT

7.4.1 The key areas of responsibility for handling emergency situations on-board the Drill King depends on:

- the OIM, who is in overall command and directs and controls the operations
- personnel with specific emergency duties which includes all regular personnel on duty at the time of the emergency, as well as some off-duty personnel
- other persons, which includes off-duty regular personnel (unless given on-call emergency duties), visitors, casual contractors and all others without a specified emergency role.

7.4.2 The tasks these persons perform are drilled regularly so that in the event of a real emergency these basic duties for the safeguard of the MODU are carried out quickly and efficiently to avoid any delay in reacting to the emergency or going to their respective muster stations.

7.4.3 In the event of an emergency situation, when the alarm has been sounded, the radio room become the Drill King's emergency control centre (ECC) for handling the incident. In all cases, the OIM takes overall charge of the incident from there.

7.4.3 When the general alarm (GA) is sounded, the following general rules apply to everyone on -board the MODU:

- stop all work
- ensure equipment is secured
- ensure the work site is made as safe as reasonably practicable
- no smoking or naked lights anywhere
- report to their designated muster points, unless otherwise directed by PA announcements.

7.4.4 The alarm status is indicated by alarm sounders throughout the Drill King, with additional flashing lights in high noise level areas. An alarm state may also be announced through use of the Public Address (PA) system. The various alarm signals are shown on the Station Bill. The location and description of the alarm and communication systems provided on the Drill King are detailed in RoMH Section 4.5.2.

7.4.5 As soon as the EEC has been mobilized, the OIM will authorise appropriate alarm signals, if they have not been previously activated. The OIM will:

1. make announcements using the PA system, giving the nature of the emergency and any relevant instructions such as the redirection of personnel to secondary mustering points, should the nature of the incident deem this necessary.
2. ensure that the emergency response and rescue vessel (ERRV) – if one is available - is advised of the situation and instructed to take up a position upwind of the MODU, with the crew on standby awaiting further instructions.
3. instruct the Radio Operator to notify the onshore ERO in order that the onshore Incident Coordination Team (see 7.5) can be mobilised. For any situation which merits the mustering of POB on board Drill King, the Coastguard should be notified directly with further periodic updates.

7.4.6 During the initial response to the sounding of the GA, specified Drill King personnel will execute their assigned duties required to secure the MODU and muster at the appropriate location. Those Drill King personnel with specific roles to play in executing a particular procedure are given instruction on their duties on the sounding of the GA. Conformity with these duties will be tested by drills.

7.4.7 Remaining personnel will report to the primary muster stations or as redirected by the OIM to secondary locations, depending on the level of impairment, if any, of the primary areas.

7.4.8 The OIM will execute each stage of the emergency procedure as the situation develops. Account is taken of external factors such as weather conditions, proximity of other platforms and installations, helicopter availability and proximity of shipping. The combination of these external factors, in addition to the development of the situation on the MODU, affects the OIM's decision. This simple and consistent approach to the initial response provides the OIM with a quick and effective overview of the immediate impact of the emergency on POB allows resources to be allocated, in an efficient manner, to the task of responding to the incident.

7.4.9 The OIM will instruct the maintenance personnel to isolate all electrical units that are not required in controlling the situation. It may be necessary to shut down the main engines and revert to the emergency generator.

7.4.10 In an emergency situation the following chain of command is in place in the event that one or even two of the MODU's senior supervisory staff become incapacitated as a result of the emergency:

- OIM(Day)
- Senior Toolpusher(Night)
- Toolpusher.

During any emergency, it may well be prudent to reduce the manning level to the minimum possible. The table below designates 'essential personnel' on the Drill King. This list of essential personnel may vary at the sole discretion of the OIM, as dictated by the emergency situation.

Essential Personnel	Optional Essential Personnel
OIM	Operator's Representative
Barge Engineer	Driller
Senior Toolpusher	Derrickman
Radio Operator	Toolpusher
Medic	Mud Engineer
Crane Operator	Cementer
Electrician	Assistant Driller

7.5 ONSHORE INCIDENT COORDINATION TEAM

7.5.1 Regal Drilling Inc.'s onshore Incident Coordination Team (ICT) for incidents in European waters is based in Stavanger, Norway. Its function is to co- ordinate back-up services for the Drill King, with the extent of its involvement dependent on the extent and seriousness of the situation. The ICT will try to

relieve the OIM and Radio Operator on the Drill King from as many dealings with external bodies and authorities as possible. However, if the incident requires immediate assistance, then coastguard and other rescue services will be contacted directly from the Drill King in the first instance before the Drill King makes contact with the ICT.

7.5.2 To initiate the Regal Drilling Inc. ICT, the Drill King OIM will contact the 24-hour on-call Regal Drilling Inc. Emergency Response Operator, who will assemble the ICT and start-up the Regal Drilling Inc. Emergency Response Centre (ERC) in Ognedal Buildings, Stavanger. The ICT will respond to a call-out in accordance with the instructions, guidelines and check-lists contained in the Regal Drilling ICT Manual.

7.5.3 The ICT will consist of the following:

- Regal Drilling Inc. Duty Drilling Manager;
- Emergency Response Coordinator;
- HSEQ Coordinator;
- Drill King onshore Rig Manager;
- HR Duty Manager;
- Regal Drilling Media Relations Duty Manager.

Annex 10 – Case Study: Verification

EXTRACT FROM PRODUCTION PRINCESS FPSO RoMH - Section 5.4 Verification

5.4.1 Any safety and environmental critical system/equipment on-board the Production Princess will be subject to independent verification. The Production Princess is also subject to routine surveys under the class rules of our classification society, American Bureau of Shipping (ABS). These survey requirements are complementary to the verification scheme, but do not duplicate it.

5.4.2 The verification scheme incorporates the following:
'safety and environmental critical elements' which are considered to be systems and equipment which is intended to prevent or limit the effect of a major accident, and whose failure could cause or contribute substantially to a major accident.

Performance standards for those systems/equipment

5.4.3 The Production Princess's verification scheme was developed in-house. This process identified what are considered to be the safety and environmental critical elements on board, and then decided on the achievable performance standards for those elements. The Table below lists all the SECEs, grouped into broad processes:

SECE System	**List of SECEs**
Fire and Gas Detection	1. Fire detection systems 2. Gas detection systems
Active Fire Protection	3. Deluge systems 4. Sprinkler systems 5. Fixed fire-fighting system in engine room 6. Portable fire-fighting equipment
Passive Fire Protection	7. Process vessel passive fire protection 8. Primary structure passive fire protection
Electrical equipment	9. Hazardous area equipment
Emergency shut down	10. Main engine room shut-down systems
Vessel Stability	11. Ballast Tank level monitoring and control 12. Ballast Pump Room Flood alarms 13. Bilge alarm system 14. Watertight door indication and control system
Vessel Position Keeping	15. Mooring system 16. Towing system
Diving spread	17. Diving Bell life support systems 18. Diving bell lifting equipment and systems
Escape and evacuation	19. Temporary refuge 20. Alternative muster stations 21. Protected escape routes 22. Protected embarkation areas 23. TEMPSCs 24. Life rafts 25. Escape to sea arrangements 26. Evacuation personal equipment (Immersion suits & life vests) 27. Protective equipment (Breathing apparatus escape sets and PPE for fire-fighting team)

Ventilation equipment	28. Temporary refuge HVAC system 29. Process control room HVAC 30. Accommodation HVAC
Well intervention equipment	31. To be assessed prior to well intervention operations

5.4.4 Following the identification of the SECEs, the performance standards for each of the SECE systems was created under four main parameters:

- functionality
- availability/reliability
- survivability

The performance standards are recorded in the Production Princess Major Accident Hazards Register, which also includes the scope and frequency of the verification inspections of those elements.

5.4.5 Apart from the Vessel Position Keeping SECEs (which we consider are included within the ABS class survey inspections), all other verification activity is carried out by our corporate Verification Department based in Aberdeen. The principles applied in selecting the personnel to carry out work to deliver the Production Princess verification scheme were based on the level of technical expertise, knowledge and experience available, and this selection process is covered by our corporate audits to ensure the correct level of competence is available to undertake verification activity.

5.4.6 Reporting is carried out by exemption and any findings, including non-compliances, are recorded and outstanding recommendations or deficiencies documented on the appropriate form and forwarded to the Production Princess OIM for action. In addition, all such recommendations are reviewed and discussed by the senior corporate management with responsibility for this FPSO, in conjunction with the results of Class surveys undertaken by ABS, and appropriate action taken.

5.4.7 The verification scheme, which forms an integral part of the management system, is subject to continuous monitoring and review throughout the Production Princess' life, and should any deficiencies be identified the scope and frequency of the SECE testing and examinations will be amended accordingly.

5.4.8 The verification arrangements described in this RoMH are restricted to the Production Princess' permanent equipment and systems. If any safety or environmentally critical equipment is brought on-board the Production Princess by a third party or sub-contractor equipment, for instance during a combined operation or during modification /maintenance projects, it will be included in the verification scheme.

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