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Offshore Operations Risk Assessment For MWS.- PART2

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ارزیابی ریسک در عملیاتهای فراساحلی برای بازرسان تضمین عملیات- قسمت۲

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All respectful ICS' Surveyors
With Gratitude,

With respect to need of the attitude based on risk in offshore operations, the attached technical information about Offshore Operations Risk Assessment for MWS, PART2, has been sent for your kind information.

The electronic file of this document could be found at the following address:

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Manager of Convention & Legislation Department
ICS

کلیه بازرسان محترم ICS

با سلام و احترام

با توجه به ضرورت نگرش بر مبنای ریسک در عملیات دریایی، بپیوست اطلاعیه فنی در خصوص ارزیابی ریسک در عملیاتهای فراساحلی برای بازرسان تضمین عملیات، قسمت دوم، حضورتان ایفاد می گردد.

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همچنین نسخه الکترونیکی این سند از طریق پست الکترونیکی به کلیه مشتریان و بازرسان محترم موسسه ارسال می گردد.

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Selection of risk assessment techniques

This clause describes how techniques for risk assessment may be selected. Further explain a range of tools and techniques that can be used to perform a risk assessment or to assist with the risk assessment process. It may sometimes be necessary to employ more than one method of assessment.

Selection of techniques

Risk assessment may be undertaken in varying degrees of depth and detail and using one or many methods ranging from simple to complex. The form of assessment and its output should be consistent with the risk criteria developed as part of establishing the context. Further illustrates the conceptual relationship between the broad categories of risk assessment techniques and the factors present in a given risk situation, and provides illustrative examples of how organizations can select the appropriate risk assessment techniques for a particular situation.

In general terms, suitable techniques should exhibit the following characteristics:

- it should be justifiable and appropriate to the situation or organization under consideration;
- it should provide results in a form which enhances understanding of the nature of the risk and how it can be treated;
- it should be capable of use in a manner that is traceable, repeatable and verifiable.

The reasons for the choice of techniques should be given, with regard to relevance and suitability. When integrating the results from different studies, the techniques used and outputs should be comparable.

Once the decision has been made to perform a risk assessment and the objectives and scope have been defined, the techniques should be selected, based on applicable factors such as:

- the objectives of the study. The objectives of the risk assessment will have a direct bearing on the techniques used. For example, if a comparative study between different options is being undertaken, it may be acceptable to use less detailed consequence models for parts of the system not affected by the difference;
- the needs of decision-makers. In some cases, a high level of detail is needed to make a good decision, in others a more general understanding is sufficient;
- the type and range of risks being analyzed;
- the potential magnitude of the consequences. The decision on the depth to which risk assessment is carried out should reflect the initial perception of consequences (although this may have to be modified once a preliminary evaluation has been completed);
- the degree of expertise, human and other resources needed. A simple method, well done, may provide better results than a more sophisticated procedure poorly done, so long as it meets the objectives and scope of the assessment. Ordinarily, the effort put into the assessment should be consistent with the potential level of risk being analyzed;

- the availability of information and data. Some techniques require more information and data than others;
- the need for modification/updating of the risk assessment. The assessment may need to be modified/updated in future and some techniques are more amendable than others in this regard;
- any regulatory and contractual requirements.

Various factors influence the selection of an approach to risk assessment such as the availability of resources, the nature and degree of uncertainty in the data and information available, and the complexity of the application.

Availability of resources

Resources and capabilities which may affect the choice of risk assessment techniques include:

- the skills experience capacity and capability of the risk assessment team;
- constraints on time and other resources within the organization;
- the budget available if external resources are required.

The nature and degree of uncertainty

The nature and degree of uncertainty requires an understanding of the quality, quantity and integrity of information available concerning the risk under consideration. This includes the extent to which sufficient information about the risk, its sources and causes, and its consequences to the achievement of objectives is available. Uncertainty can stem from poor data quality or the lack of essential and reliable data. To illustrate, data collection methods may change, the way organizations use such methods may change or the organization may not have an effective collection method in place at all, for collecting data about the identified risk.

Uncertainty can also be inherent in the external and internal context of the organization.

Available data do not always provide a reliable basis for the prediction of the future. For unique types of risks, historical data may not be available or there may be different interpretations of available data by different stakeholders. Those undertaking risk assessment need to understand the type and nature of the uncertainty and appreciate the implications for the reliability of the risk assessment results. These should always be communicated to decision-makers.

Complexity

Risks can be complex in themselves, as, for example, in complex systems which need to have their risks assessed across the system rather than treating each component separately and ignoring interactions. In other cases, treating a single risk can have implications elsewhere and can impact on other activities. Consequential impacts and risk dependencies need to be understood to ensure that in managing one risk, an intolerable situation is not created elsewhere. Understanding the complexity of a single risk or of a portfolio of risks of an organization is crucial for the selection of the appropriate method or techniques for risk assessment.

Application of risk assessment during life cycle phases

Many activities, projects and products can be considered to have a life cycle starting from initial concept and definition through realization to a final completion which might include decommissioning and disposal of hardware.

Risk assessment can be applied at all stages of the life cycle and is usually applied many times with different levels of detail to assist in the decisions that need to be made at each phase.

Life cycle phases have different needs and require different techniques For example during the concept and definition phase, when an opportunity is identified, risk assessment may be used to decide whether to proceed or not.

Where several options are available, risk assessment can be used to evaluate alternative concepts to help decide which provides the best balance of risks.

During the design and development phase, risk assessment contributes to

- ensuring that system risks are tolerable,
- the design refinement process,
- cost effectiveness studies,
- identifying risks impacting upon subsequent life-cycle phases.

As the activity proceeds, risk assessment can be used to provide information to assist in developing procedures for normal and emergency conditions.

Types of risk assessment techniques

Risk assessment techniques can be classified in various ways to assist with understanding their relative strengths and weaknesses.

Comparison of risk assessment techniques

Types of technique

The first classification shows how the techniques apply to each step of the risk assessment

process as follows:

- risk identification;
- risk analysis – consequence analysis;
- risk analysis – qualitative, semi-quantitative or quantitative probability estimation;
- risk analysis – assessing the effectiveness of any existing controls;
- risk analysis – estimation the level of risk;
- risk evaluation.

For each step in the risk assessment process, the application of the method is described as being either strongly applicable, applicable or not applicable.

Factors influencing selection of risk assessment techniques

Next the attributes of the methods are described in terms of

- complexity of the problem and the methods needed to analyze it,
- the nature and degree of uncertainty of the risk assessment based on the amount of information available and what is required to satisfy objectives,
- the extent of resources required in terms of time and level of expertise, data needs or cost,
- whether the method can provide a quantitative output.

Examples of types of risk assessment methods available are listed in the next table where each method is rated as high medium or low in terms of these attributes.

Tools and techniques	Risk assessment process				
	Risk Identification	Risk analysis			Risk evaluation
		Consequence	Probability	Level of risk	
Brainstorming	SA	NA	NA	NA	NA
Structured or semi-structured interviews	SA	NA	NA	NA	NA
Delphi	SA	NA	NA	NA	NA
Check-lists	SA	NA	NA	NA	NA
Primary hazard analysis	SA	NA	NA	NA	NA
Hazard and operability studies (HAZOP)	SA	SA	A	A	A
Hazard Analysis and Critical Control Points (HACCP)	SA	SA	NA	NA	SA
Environmental risk assessment	SA	SA	SA	SA	SA
Structure « What if? » (SWIFT)	SA	SA	SA	SA	SA
Scenario analysis	SA	SA	A	A	A

Tools and techniques	Risk assessment process				
	Risk Identification	Risk analysis			Risk evaluation
		Consequence	Probability	Level of risk	
Business impact analysis	A	SA	A	A	A
Root cause analysis	NA	SA	SA	SA	SA
Failure mode effect analysis	SA	SA	SA	SA	SA
Fault tree analysis	A	NA	SA	A	A
Event tree analysis	A	SA	A	A	NA
Cause and consequence analysis	A	SA	SA	A	A
Cause-and-effect analysis	SA	SA	NA	NA	NA
Layer protection analysis (LOPA)	A	SA	A	A	NA
Decision tree	NA	SA	SA	A	A
Human reliability analysis	SA	SA	SA	SA	A
Bow tie analysis	NA	A	SA	SA	A
Reliability centered maintenance	SA	SA	SA	SA	SA
Sneak circuit analysis	A	NA	NA	NA	NA
Markov analysis	A	SA	NA	NA	NA
Monte Carlo simulation	NA	NA	NA	NA	SA
Bayesian statistics and Bayes Nets	NA	SA	NA	NA	SA
FN curves	A	SA	SA	A	SA
Risk indices	A	SA	SA	A	SA
Consequence/probability matrix	SA	SA	SA	SA	A
Cost/benefit analysis	A	SA	A	A	A
Multi-criteria decision analysis (MCDA)	A	SA	A	SA	A

1) Strongly applicable.
2) Not applicable.
3) Applicable.

Type of risk assessment technique	Description	Relevance of influencing factors			Can provide Quantitative output
		Resources and capability	Nature and degree of uncertainty	Complexity	
LOOK-UP METHODS					
Check-lists	A simple form of risk identification. A technique which provides a listing of typical uncertainties which need to be considered. Users refer to a previously developed list, codes or standards	Low	Low	Low	No
Preliminary hazard analysis	A simple inductive method of analysis whose objective is to identify the hazards and hazardous situations and events that can cause harm for a given activity, facility or system	Low	High	Medium	No
SUPPORTING METHODS					
Structured Interview and brainstorming	A means of collecting a broad set of ideas and evaluation, ranking them by a team. Brainstorming may be stimulated by prompts or by one-on-one and one-on-many interview techniques	Low	Low	Low	No
Delphi technique	A means of combining expert opinions that may support the source and influence identification, probability and consequence estimation and risk evaluation. It is a collaborative technique for building consensus among experts. Involving independent analysis and voting by experts	Medium	Medium	Medium	No
SWIFT Structured "what-if")	A system for prompting a team to identify risks. Normally used within a facilitated workshop. Normally linked to a risk analysis and evaluation technique	Medium	Medium	Any	No
Human reliability analysis (HRA)	Human reliability assessment (HRA) deals with the impact of humans on system performance and can be used to evaluate human error influences on the system	Medium	Medium	Medium	Yes

Type of risk assessment technique	Description	Relevance of influencing factors			Can provide Quantitative output
		Resources and capability	Nature and degree of uncertainty	Complexity	
SCENARIO ANALYSIS					
Root cause analysis (single loss analysis)	A single loss that has occurred is analyzed in order to understand contributory causes and how the system or process can be improved to avoid such future losses. The analysis shall consider what controls were in place at the time the loss occurred and how controls might be improved	Medium	Low	Medium	No
Scenario analysis	Possible future scenarios are identified through imagination or extrapolation from the present and different risks considered assuming each of these scenarios might occur. This can be done formally or informally qualitatively or quantitatively	Medium	High	Medium	No
Toxicological risk assessment	Hazards are identified and analyzed and possible pathways by which a specified target might be exposed to the hazard are identified. Information on the level of exposure and the nature of harm caused by a given level of exposure are combined to give a measure of the probability that the specified harm will occur	High	High	Medium	Yes
Business impact analysis	Provides an analysis of how key disruption risks could affect an organization's operations and identifies and quantifies the capabilities that would be required to manage it	Medium	Medium	Medium	No
Fault tree analysis	A technique which starts with the undesired event (top event) and determines all the ways in which it could occur. These are displayed graphically in a logical tree diagram. Once the fault tree has been developed, consideration should be given to ways of reducing or eliminating potential causes / sources	High	High	Medium	Yes
Event tree analysis	Using inductive reasoning to translate probabilities of different initiating events into possible outcomes	Medium	Medium	Medium	Yes
Cause/ consequence analysis	A combination of fault and event tree analysis that allows inclusion of time delays. Both causes and consequences of an initiating event are considered	High	Medium	High	Yes

Type of risk assessment technique	Description	Relevance of influencing factors			Can provide Quantitative output
		Resources and capability	Nature and degree of uncertainty	Complexity	
SCENARIO ANALYSIS					
Cause-and-effect analysis	An effect can have a number of contributory factors which may be grouped into different categories. Contributory factors are identified often through brainstorming and displayed in a tree structure or fishbone diagram	Low	Low	Medium	No
FUNCTION ANALYSIS					
FMEA and FMECA	FMEA (Failure Mode and Effect Analysis) is a technique which identifies failure modes and mechanisms, and their effects. There are several types of FMEA: Design (or product) FMEA which is used for components and products, System FMEA which is used for systems, Process FMEA which is used for manufacturing and assembly processes, Service FMEA and Software FMEA. FMEA may be followed by a criticality analysis which defines the significance of each failure mode, qualitatively, semi-qualitatively, or quantitatively (FMECA). The criticality analysis may be based on the probability that the failure mode will result in system failure, or the level of risk associated with the failure mode, or a risk priority number	Medium	Medium	Medium	Yes
Reliability centered maintenance	A method to identify the policies that should be implemented to manage failures so as to efficiently and effectively achieve the required safety, availability and economy of operation for all types of equipment	Medium	Medium	Medium	Yes
Sneak analysis (Sneak circuit analysis)	A methodology for identifying design errors. A sneak condition is a latent hardware, software, or integrated condition that may cause an unwanted event to occur or may inhibit a desired event and is not caused by component failure. These conditions are characterized by their random nature and ability to escape detection during the most rigorous of standardized system tests. Sneak conditions can cause improper operation, loss of system availability, program delays, or even death or injury to personnel	Medium	Medium	Medium	No

Type of risk assessment technique	Description	Relevance of influencing factors			Can provide Quantitative output
		Resources and capability	Nature and degree of uncertainty	Complexity	
HAZOP Hazard and operability studies	A general process of risk identification to define possible deviations from the expected or intended performance. It uses a guideword based system. The criticalities of the deviations are assessed	Medium	High	High	No
HACCP Hazard analysis and critical control points	A systematic, proactive, and preventive system for assuring product quality, reliability and safety of processes by measuring and monitoring specific characteristics which are required to be within defined limits	Medium	Medium	Medium	No
CONTROLS ASSESSMENT					
LOPA (Layers of protection analysis)	(May also be called barrier analysis). It allows controls and their effectiveness to be evaluated	Medium	Medium	Medium	Yes
Bow tie analysis	A simple diagrammatic way of describing and analyzing the pathways of a risk from hazards to outcomes and reviewing controls. It can be considered to be a combination of the logic of a fault tree analyzing the cause of an event (represented by the knot of a bow tie) and an event tree analyzing the consequences	Medium	High	Medium	Yes
STATISTICAL METHODS					
Markov analysis	Markov analysis, sometimes called State-space analysis, is commonly used in the analysis of repairable complex systems that can exist in multiple states, including various degraded states	High	Low	High	Yes

Type of risk assessment technique	Description	Relevance of influencing factors			Can provide Quantitative output
		Resources and capability	Nature and degree of uncertainty	Complexity	
Monte-Carlo analysis	Monte Carlo simulation is used to establish the aggregate variation in a system resulting from variations in the system, for a number of inputs, where each input has a defined distribution and the inputs are related to the output via defined relationships. The analysis can be used for a specific model where the interactions of the various inputs can be mathematically defined. The inputs can be based upon a variety of distribution types according to the nature of the uncertainty they are intended to represent. For risk assessment, triangular distributions or beta distributions are commonly used	High	Low	High	Yes
Bayesian analysis	A statistical procedure which utilizes prior distribution data to assess the probability of the result. Bayesian analysis depends upon the accuracy of the prior distribution to deduce an accurate result. Bayesian belief networks model cause-and-effect in a variety of domains by capturing probabilistic relationships of variable inputs to derive a result	High	Low	High	Yes