

No. 127 A Guide to Risk Assessment in Ship Operations

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INTRODUCTION

Although it is not often referred to as such, the development and implementation of a documented safety management system is an exercise in risk management. The drafting or amendment of written procedures involves looking at the company's activities and operations, identifying what could go wrong, and deciding what should be done to try to prevent it. The documented procedures are the means by which the controls are applied.

There is no universally accepted definition of risk, but the one commonly applied and regarded as authoritative in most industrial contexts is:

“Effect of uncertainty on objectives”

(ISO 31000:2018 definition 2.1 and ISO Guide 73:2009, definition 1.1)

IMO defines risk as:

“The combination of the frequency and the severity of the consequence.”

(MSC-MEPC.2/Circ.12/Rev.2)

In other words, risk has two components: likelihood of occurrence and severity of the consequences.

A hazard is a substance, situation or practice that has the potential to cause harm. Briefly, what we are concerned with, therefore, is:

- the identification of hazards
- the assessment of the risks associated with those hazards
- the application of controls to reduce the risks that are deemed intolerable
- the monitoring of the effectiveness of the controls

The controls may be applied either to reduce the likelihood of occurrence of an adverse event and/or to reduce the severity of the consequences. The risks we are concerned with are those that are reasonably foreseeable, and relate to:

- the health and safety of all those who are directly or indirectly involved in the activity, or who may be otherwise affected
- the property of the company and others
- the environment

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1. WHAT THE CODE SAYS ABOUT RISK ASSESSMENT

Paragraph 1.2.2.2 of the ISM Code states: "Safety management objectives of the Company should... assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards". Although there is no further, explicit reference to this general requirement in the remainder of the Code, risk assessment of one form or another is essential to compliance with most of its clauses.

It is important to recognize that the company is responsible for identifying the risks associated with its particular ships, operations and trade. It is not sufficient to rely on compliance with generic statutory and class requirements, and with general industry guidance. These should be seen as a starting point for ensuring the safe operation of the ship.

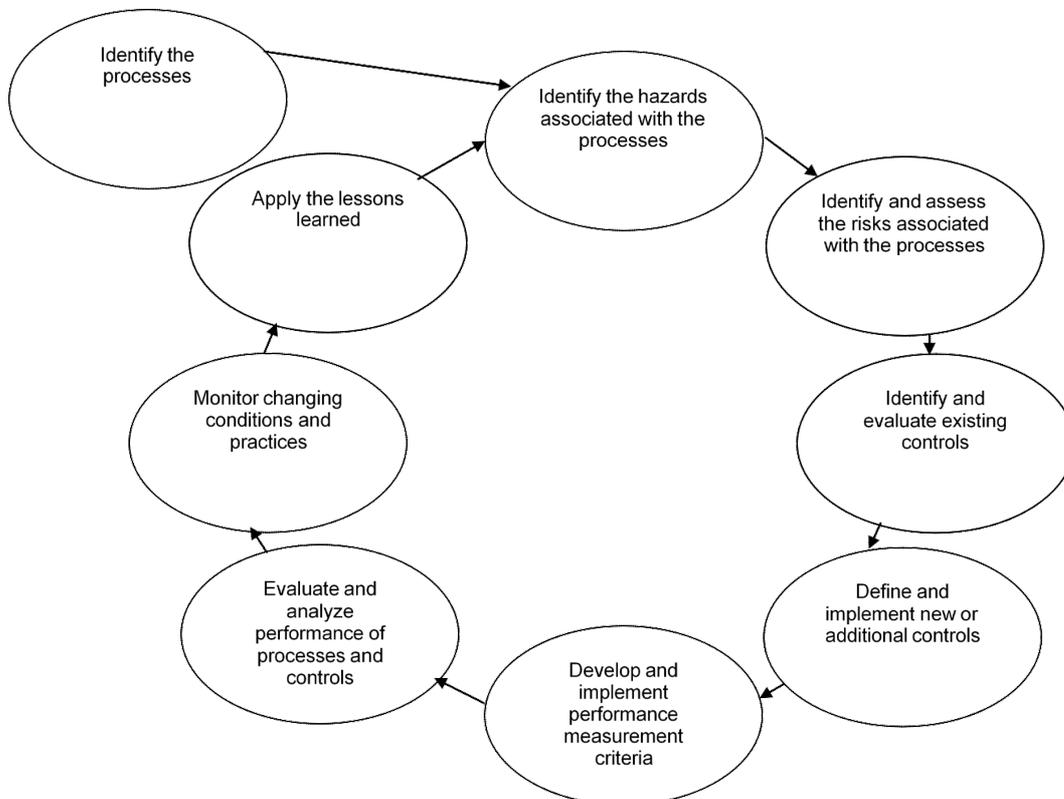
The ISM Code does not specify any particular approach to the management of risk, and it is for the company to choose methods appropriate to its organizational structure, its ships and its trades. The methods may be more or less formal, but they must be systematic if assessment and response are to be complete and effective, and the entire exercise should be documented so as to provide evidence of the decision-making process.

2. THE RISK ASSESSMENT PROCESS

Risk assessment may be defined as:

"Overall process of risk identification, risk analysis and risk evaluation"
(ISO 31000:2018 definition 2.16 and ISO Guide 73:2009, definition 3.4.1)

The risk assessment process may be summarized by the flowchart below.



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The identification of hazards is the first and most important step in risk assessment process since all that follows depends on it. It must be complete and accurate, and should be based, as far as possible, on observation of the activity. But hazard identification is not as easy as it may first appear.

Completeness and accuracy can be achieved only if the process is systematic. Those charged with the task must have sufficient training and guidance to ensure that it is conducted in a thorough and consistent manner. The terms used should be clearly defined and the process must be fully described; for example, hazards must not be confused with incidents, and incidents must not be confused with consequences.

There are many methods and tools used for risk assessment available and the Company is free to use the most suitable one. Some of these most used methods of risk assessment include:

- Checklists
- Preliminary hazard analysis
- Job safety analysis
- Quantitative risk analysis
- Qualitative risk analysis (Preliminary Hazard Analysis)
- SWIFT
- What if analysis
- 5 Whys analysis
- Fault tree analysis (FTA)
- Event tree analysis (ETA)
- Bow tie analysis (BTA)
- Failure mode and effects analysis (FMEA)
- Hazard and operational analysis (HAZOP)

Guidance on selection and application of risk assessment techniques is available, for example in the international standard IEC 31010:2019 - Risk management – Risk assessment techniques.

In the example of Qualitative Risk Analysis (Preliminary Hazard Analysis) method the risks associated with each hazard are evaluated in terms of the likelihood of harm and the potential consequences. This, in turn, enables the organization to establish priorities and to decide where its scarce resources may be used to greatest effect.

The combination of likelihood and consequence is normally illustrated as follows:

RISK ESTIMATOR

| 5 x 5 RISK MATRIX | | | | | | |
|-------------------|-----------------|---------------|---------------|---------------|---------------|---------------|
| LIKELIHOOD | Highly Probable | 5 Moderate | 10 Major | 15 Major | 20 Severe | 25 Severe |
| | Probable | 4 Moderate | 8 Moderate | 12 Major | 16 Major | 20 Severe |
| | Possible | 3 Minor | 6 Moderate | 9 Moderate | 12 Major | 15 Major |
| | Unlikely | 2 Minor | 4 Moderate | 6 Moderate | 8 Moderate | 10 Major |
| | Rare | 1 Minor | 2 Minor | 3 Minor | 4 Moderate | 5 Moderate |
| | | Very Low | Low | Medium | High | Very High |
| CONSEQUENCES | | | | | | |

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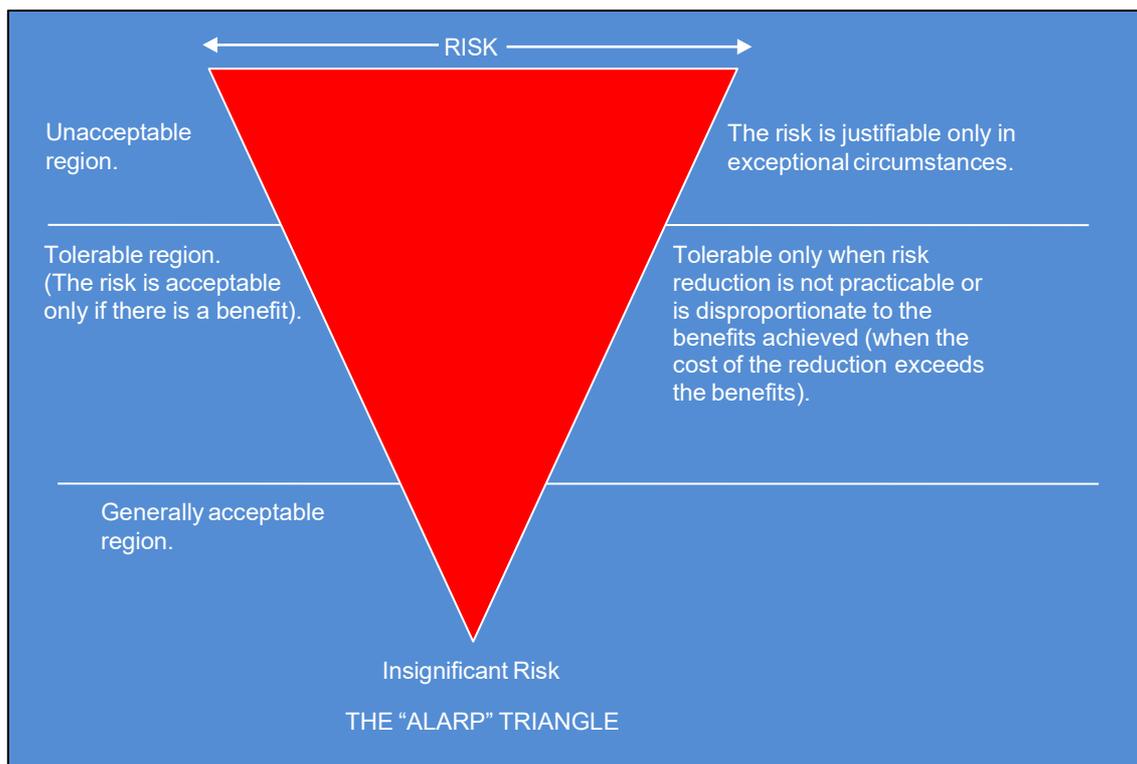
The table below indicates the recommended response in each case.

| | |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Minor | No additional controls are required. Monitoring is required to ensure control is maintained. |
| Moderate | Efforts are required to reduce risk. Controls are to be implemented within a specified time. |
| Major | New work not to start until risk reduced. If work in progress, urgent action to be taken. Considerable resources may be required. |
| Severe | Work shall not be started or continued until the risk has been reduced. If reduction is not possible, the activity shall be prohibited. |

The tables above are for illustrative purposes and are not mandatory. The risk matrix may be expanded to include more rows and columns, depending on how finely the company wishes to distinguish the categories. The terms used for likelihood and consequence may be changed to assist understanding. For example, likelihood may be expressed in terms of “once per trip”, “once per ship year” or “once per fleet year”, and consequence may be made more specific by the use of “first aid injury”, “serious injury” or “death”, not forgetting the consequences for property and the environment.

When deciding on priorities for the application of controls, the frequency of the activity should also be taken into account; for example, it may be more urgent to address a “moderate” level of risk in a process that occurs every day than to impose controls over an activity that involves “substantial” risk, but will not be carried out in the near future.

Furthermore, the terms applied to the levels of risk in the table above should not be interpreted too rigidly. Risk should be reduced to a level that is as low as is reasonably practicable (ALARP). If a “tolerable” level of risk can be reduced still further for a reasonable cost and with little effort, then it should be. Standards of tolerability tend to be far stricter after an accident than before. The ALARP concept is often illustrated thus



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The people chosen to undertake risk assessments should be those most familiar with the area, and who have most experience of the task to be assessed. The process must be systematic, and in order to make it so, it may help to categorize areas and activities as in the following example.

| | |
|-------------------------------|---------------------------------------------------------------------------------------|
| Assessment Unit | : Deck |
| Activity | : Tank cleaning |
| Hazard | : Toxic atmosphere or lack of oxygen |
| Risk (before controls) | : Intolerable (likely and extremely harmful) |
| Recommended Controls | : Atmospheric testing, ventilation, use or availability of breathing apparatus |

3. ENSURING CONTINUITY AND FLEXIBILITY

All too often, companies carry out risk assessment exercises as separate, isolated activities. The process is regarded as complete once the forms are filled in and filed away. But if new or enhanced controls have been identified, they must be implemented, usually by inclusion in the company's documented procedures.

If it is to make a real, practical contribution to improving safety and preventing pollution, the management of risks must be continual and flexible. A risk assessment is nothing more than a "snapshot". The organization, the technology, working practices, the regulatory environment and other factors are constantly changing, and subsequently arising hazards may not be included. Assessments must be reviewed regularly and in the light of experience; for example, an increase in the number of accidents or hazardous occurrences may indicate that previously implemented controls are no longer effective. Additional risk assessments will be needed for infrequent activities or those being undertaken for the first time.

The formal risk assessment exercise is only one of many contributions to risk management. Much more important are flexibility and responsiveness to a dynamic environment and its dangers. The organization must ensure that it is sensitive to the signals provided by internal audits, routine reporting, company and masters' reviews, accident reports, etc., and that it responds promptly and effectively.

4. PEOPLE

It is important to remember the subjective nature of risk perception; for example, one person swinging 30m above the deck in a bosun's chair may have a very different view of the risks involved from that of another person in the same situation. This divergence in responses to risk arises from differences in experience, training and temperament, and it can be considerable. Who decides what is tolerable and what is acceptable? Because the judgements of the people engaged in an activity may not coincide with those of the assessors, it is essential that operational staff be involved in the assessment process. They have knowledge of the activities and experience in their conduct, and they have to live with the consequences of the decisions that are taken.

Furthermore, different levels of experience and training mean that the hazards and risks associated with an activity can vary greatly with the people who carry it out, and conditions may be very different from those prevailing at the time of the assessment.

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Risk is not a constant, measurable, concrete entity. Quantitative assessments of risk must be understood as estimates that are made at particular moments and are subject to considerable degrees of uncertainty. They are not precise measurements, and the rarer (and usually more catastrophic) the event, the less reliable the historical data and the estimates based on them will be.

The best safeguard against accidents is a genuine safety culture - awareness and constant vigilance on the part of all those involved, and the establishment of safety as a permanent and natural feature of organizational decision-making.

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