Understanding the risk assessment that recently amended to the ISM Code

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مستخلص:

تعد صناعة النقل البحرى من الأنشطة المحفوفة بالمخاطر، ونظرا لنمو صناعة النقل البحرى فان المخاطر والحوادث المرتبطة بهذا النشاط البحرى أيضاً فى ازدياد مما يظهر الحاجة إلى إجراءات وقائية، وقد قامت المنظمة البحرية الدولية وهى السلطة التشريعية الدولية الأساسية فى المجتمع البحرى، بإبرام المعاهدات وبإصدار القواعد والتوصيات لرفع مستوى سلامة تشغيل السفن وحماية البيئة البحرية. وتعد المدونة الدولية لإدارة السلامة البحرية احد أهم المتطلبات الحتمية التى أصدرتها المنظمة البحرية الدولية كإجراءات وقائية للسلامة البحرية تطبق من قبل الشركات الملاحية على مستوى الإدارة العليا والعاملين والسفن .

وتعد المدونة الدولية لإدارة السلامة البحرية نظاماً عالي القيمة لإدارة السلامة البحرية خاصة لملاك السفن أو شركات الملاحة البحرية، لأنه يعمل من خلال دمج كل المفاهيم المتعلقة بإدارة السلامة البحرية فى نظام متكامل واحد تقوم عليه سياسة واحتياطات السلامة البحرية، والقاعدة الأساسية التى بنيت عليها المدونة هى فلسفة الاستمرار فى التطوير لمتطلبات السلامة البحرية. وبعد مرور اثني عشر عاما من تطبيق المدونة بشكل حتمي على الشركات والسفن، قامت المنظمة البحرية الدولية بعمل مراجعة للمدونة، وأدخلت أول تعديلاتها على المدونة متضمنة إضافة ما يتعلق بعملية "تقييم المخاطر" والتى اعتمدت فى 4 ديسمبر 2008 وأصبحت حتمية التطبيق, فى 1يوليو 2010، وعلى جميع الشركات الملاحية "مديري السفن والأساطيل البحرية" اتخاذ الإجراءات اللازمة والحيطة للتأكد من مواءمة شركاتهم مع المتطلبات الجديدة للمدونة .

توضح هذه الورقة الخطوات والأوجه الأساسية لمفهوم عملية " تقييم المخاطر " والتى تعد القاعدة الأساسية فى عملية إدارة المخاطر وهى الهدف الاساسى الذى وضعت من اجله المنظمة البحرية الدولية المدونة الدولية لإدارة السلامة البحرية فى بدايتها .

Abstract:

Shipping industry is a risky activity. Due to increasing waterborne transportation "shipping industry" the risk of a hazardous accident increases and therefore manifold preventive actions are needed. The International Maritime Organization (IMO), as a main legislative authority in the maritime community, has set down plenary rules and recommendations that are utilized in the safety operations of ships and marine environment protection. One of these obligatory requirements is the "International Safety Management Code –ISM Code" that requires proactive attitude both from the top management and operational workers in the shipping companies.

The Code is of great value to prudent owners and operators, as it provides a single system incorporating all aspects of safety policies and procedures. Furthermore, the fundamental philosophy of the ISM Code is the philosophy of continuous safety improvement.

Since the year 2002 "ten years after ISM code became mandatory"; the IMO has issued the first revision of the Code and its amendments including an important clarification with regard to the relevance of risk assessment to the Code which adopted on 4th December 2008 and became mandatory on 1st July 2010. All companies should be aware of these revisions and be taking steps to ensure their compliance.
The paper reveals, the phases of risk assessment process in basic approach as the core of the total risk management system, which is the fundamental intend of ISM Code even before the recent amendments.

1- Introduction:

It has been perceived that the shipping industry, compared to other industries is risky and in necessitate of high safety procedures, the shipping industry is an integral part of the international trading system and its function is to facilitate international trade, it is responsible for the carriage of about 90% of world trade and is vital to the functioning of the global economy· Nowadays, the shipping industry is all time blooming , where it is immense demands for the increase of efficiency, safety, security, and protection of the environment that can be only achieved by more interests and research.

Since shipping operations present risks, it should be assessed by the shipping companies (ship operators), to determine whether operations are adequately controlled, and managed. It must establish some risk acceptance criteria. The criteria usually take the form of a frequency level, a consequence severity, or a combination of both, with an understanding that the criteria should not be exceeded. A possible system failure that violates these criteria usually results in recommendations to better manage the risks i.e. a bitter reduction of failures and accidents. [INSB, 2010]

The shipping industry has come a long way since the introduction of the ISM Code initially applied to tankers and passenger ships in July 1998 and other ships in July 2002. After more than a decade since the ISM Code implementation deadline, the IMO decided to

make an important amendment to clause (1.2.2.2) From 1 July 2010, IMO Resolution MSC.273 (85) will introduce a number of amendments to the ISM Code, including a major change to clause (1.2.2.2). The revised clause (1.2.2.2) will now require the safety management objectives of the shipping companies.

So the understanding of the concept of Risk assessment process and risk management basic became fundamental for ship's operators and ship Masters. [ISM code, 2008]

2- Risk Assessment and ISM Code

As defined in clause 1.2 of the ISM Code the requirement for the assessment and management of risks is fundamental to the Code. The ISM Code does not identify any particular approaches to the management of risk, and it is for the shipping companies to choose methods suitable to its organizational structure its ships type and its activities.

The methods may be more or less formal, but must be systematic. Moreover, the assessment and response should be complete and effective, and the entire exercise should be documented so as to provide evidence of the decision-making process. [Antonio, 2005]

Risk assessment is fundamental to conformity (ISM Code) with most of its clauses.

Risk analysis or risk assessment like safety Management System is a proactive/active system becouse the principle of Safety Management involves managing and controlling risks levels of hazards and keeping them Within acceptable levels. [IACS, 2004]

2-1 Why Risk Assessment became "Mandatory"?

- ISM Code – Explicit as amended and entering into force on 1 July 2010 (annexed Resolution MSC.273 (85))
- EU Regulations
- Flag states Requirements

The mentioned instruments make a mandatory issue of risk assessment in the Safety Management System (SMS). "Companies should assess all risks to its ships, personnel and the environment and establish appropriate safeguards" as the following:

- Companies should first identify all the risks to their operations and then assess them
- Companies should demonstrate that they have carried out a systematic examination of their operations, where things may go wrong and develop adequate controls

- Policies regarding risk assessment should be documented
- Procedures and instructions should be in place for methods chosen for risk assessment
- Responsibilities and authorities concerning risk assessment process should be defined in the SMS
- Adequate training should be provided to the personnel to the extent and level of their involvement in the risk assessment process
- Records of risk assessment should be maintained. [MSC.273 (85), 2008]

2-2 The ISM Code risk assessment perspective:

Within the safety management objectives of the Code, there has always been an implied reference to risk assessment. The IMO has traditionally shied away from making the assessment of risk and requirement mandatory. In the original version of clause (1.2.2.2) of the Code, the requirement of the company with regard to the safety management objectives include the call for to establish safeguards against all identified risks.

Risk assessment is not a newly field, formal risk assessment techniques have their origins in the Insurance industry. Risk assessment techniques can be applied in almost all areas of shipping operation. Moreover, ship operators know that to be successful, they must have a good understanding of their risks and how risks impact the people that allied with their operations, their financial performance and corporate status. [Gordon, 2010]

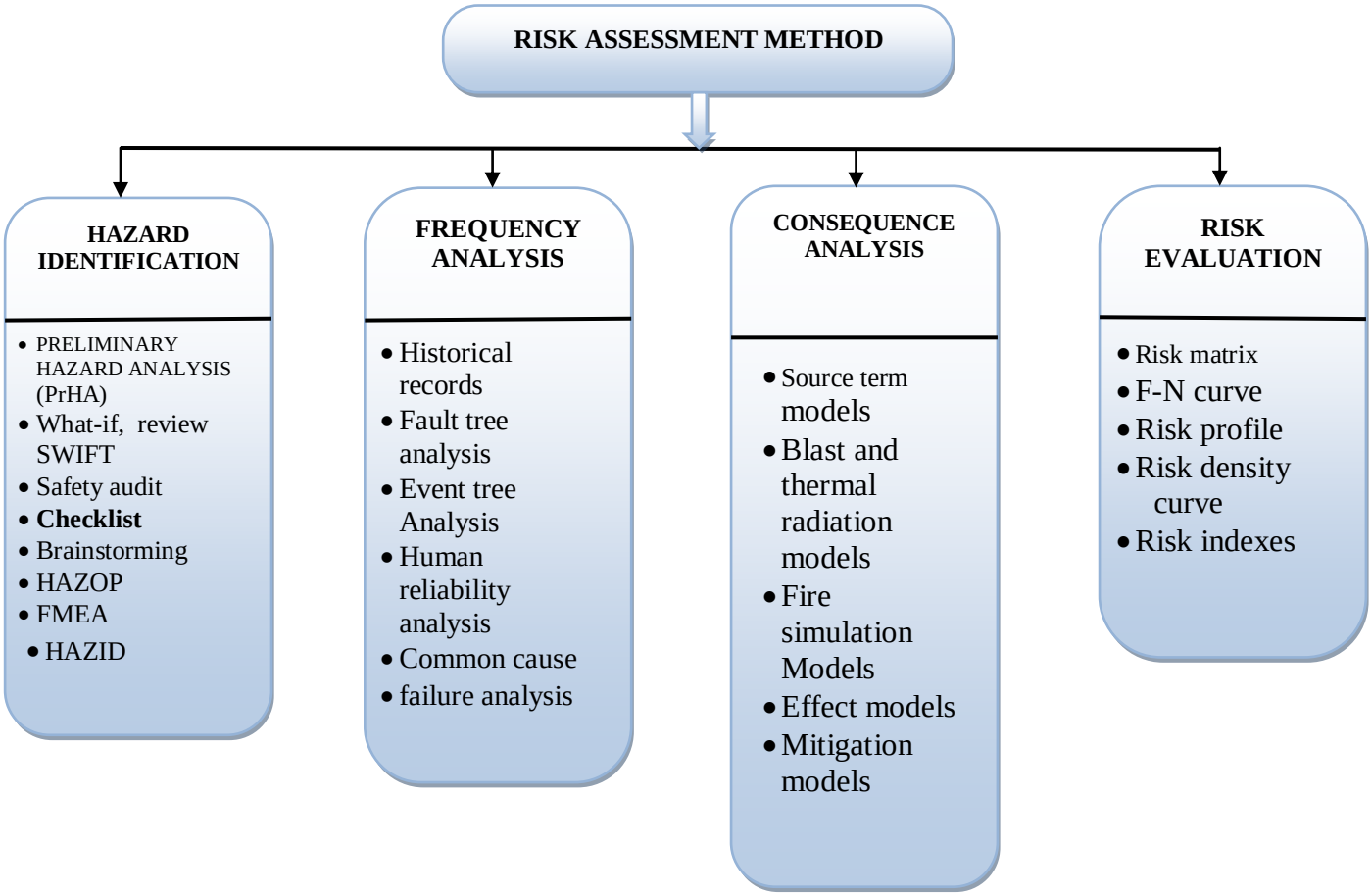
3- Risk assessment methods:

Risk assessment methodologies are significantly varied through shipping operation, ranging from effortless assessments to composite quantitative analyses with wide-ranging documentation. Since ISM is proactive and reactive procedures system, risk assessment considered an important proactive and reactive procedures system as well.

The purpose of the Risk Assessment and Risk Management is to minimize risk to personnel, property and the environment. In this respect, all activities that could adversely affect Company's operations and performance are evaluated and appropriate measures are taken to ensure that risk is either reduced or maintained at an acceptable level.

There are many different analysis models that have been developed to aid in conducting risk assessments. Examples of these methods are summarized in the figure (1).

A key to any successful risk analysis or assessment is choosing the right method (or combination of methods) for the situation at hand. For each step of the Risk Assessment Process, some of the analysis methods available to make approaches to support different types of decision making within the shipping operation activities.[ABS, 2004]



Fig, (1): Overview of Risk Assessment Method
Source: GL,2010

4-The risk assessment Process:

Although, there are many different Risk Assessment methodologies, in general a basic approach:

4-1 Phase 1: Identification of shipboard operations:

The potential hazards to personnel, property and the environment should be identified and the existing shipboard operations and tasks in case of introducing a new routine tasks, changes to procedures or equipment, preparation of complex or high risk jobs and projects, and incidents, accidents, serious near misses, etc.

4-2 Phase 2: Identification of Hazards – HAZID:

Hazard identification (HAZID) is the process of identifying hazards, which forms the essential first step of a risk assessment. The hazard identification may be performed dealing with the question "What can go wrong?" Hazard or Danger is posed by a situation in which there is an actual or potential threat for the crew, the ship or the environment. Overview and examples of the different methods for hazard identification and risk assessment are shown in the table below:

Hazard Identification
• **Literature review** • **Checklist** • **Scenario Analysis** • **FMEA** • **Fault Tree** • **Event Tree** • **HAZOP** • **Safety Review** • **What if? / SWIFT** • **Preliminary Hazard Analysis (PrHA)**

Fig (2) different methods for hazard identification
Source: the author

The methods for applications are in diverse sectors. It should be noted that, while the designations and implementation of individual methods may vary, the fundamental principles remain "the same" based on checklists and primarily consent qualitative risk identification and expert judgment. They are commonly applied in practice. Moreover, the identification of hazards is the first and most important step in risk assessment for any practical approach. The HAZID, to be fulfilled the existing control measures should be introduced such as existing controls/measures that may mitigate the effects of that hazards has to be taken into account. Furthermore, procedural, human recourses, training, control systems, appropriate design and construction, maintenance, communication, and use of proper equipment etc. [GL, 2010]

4-3 Phase 3: Risk Evaluation:

There are qualitative and quantitative methods for determination of risk level, in qualitative risk assessment, someone is using personal judgment whereas in quantitative can actually be measured based on company and/or industry data.

4-3-1 The concept and calculation of Risk:

Risk is a combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s). Risk is also defined as "A combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence"
IMO defines Risk as: "The combination of the frequency and the severity of the consequence." [Nomikos, 2009]

Risk = Frequency × Consequences

Frequency: of a potential undesirable event is expressed as events per unit time usually per year and should be determined from historical data if a significant number of events have occurred in the past.

Consequences: can be expressed as the number of people affected (injured or killed) property damaged amount of spill, area affected, outage time, mission delay, money lost, etc. "The outcome of an accident (quantified by some measure of severity)". [Salem, 2008]

As the total risk picture for a given activity or system can be very complex and involves many different aspects, it is often necessary to break it down into different risk scenarios. Equation below, computes the total risk for a given activity/system as the sum of the risks for each accident type and each phase of the accidental process:

$$R = \sum_i \sum_j pij.\ c_{ij}$$

R = Total risk value.
i = The number of scenarios that may lead to a particular consequence.
j = Number of phases within each accidental outcome.
p_{ij} = Probability (or frequency) of occurrence for the relevant scenario and phase.
c_{ij} = Consequence measure for the relevant scenario and phase. [Salem, 2008]

4-3-2 Frequency Determination:

Once assignment of consequences and likelihoods is complete, a risk matrix can be used as a commonly mechanism for assigning risk (and making risk acceptance decisions), using a risk categorization approach, that means risk matrix is a simple method for estimating risks according to the potential severity of and the likelihood, as described fig (3).

	Consequence		
Likelihood	Minor	Moderate	Extreme
Very unlikely	Low	Low	Medium
Unlikely	Low	Medium	Medium
Likely	Medium	Medium	**High**
Very Likely	Medium	**High**	**High**

Fig (3) consequences and likelihoods
Source: INSB, 2010

The risk matrix may be expanded to include more rows and columns, depending on how finely the shipping companies wishes to make out the categories. The terms used for likelihood and consequence may be changed to assist understanding.

Frequency/ Consequence	1 Very Unlikely	2 Remote	3 Occasional	4 Probable	5 Frequent
Catastrophic					
Critical					
Major					
Minor					

Acceptable – only ALARP actions considered

Acceptable – use ALARP principle and consider further investigations

Not Acceptable – risk reduction measures required irrespective of the cost

Fig (4) risk matrix
Source: Salem, 2008

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. [IACS, 2004]

The next step is to decide which risks are acceptable, tolerable or unacceptable. In making decisions as to whether the risk is tolerable the work force should be consulted as fig (5)

Trivial	No action is required
Tolerable	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.
Substantial	New work not to start until risk reduced. If work in progress, urgent action to be taken. Considerable resources may be required.
Intolerable	Work shall not be started or continued until the risk has been reduced. If reduction is not possible, the activity shall be prohibited.

Fig (5) Rating Scale – severity
Source: GL, 2010

4-3-3 The level of the risk using risk criteria:

- **High/Intolerable Risk:** Goal is to take steps to reduce risk to at least a medium level.
- **Medium/ Tolerable Risk:** Perform Risk Assessment and identify risk control measures.
- **Low/Negligible Risk:** Address as part of normal, on-going Improvement processes.

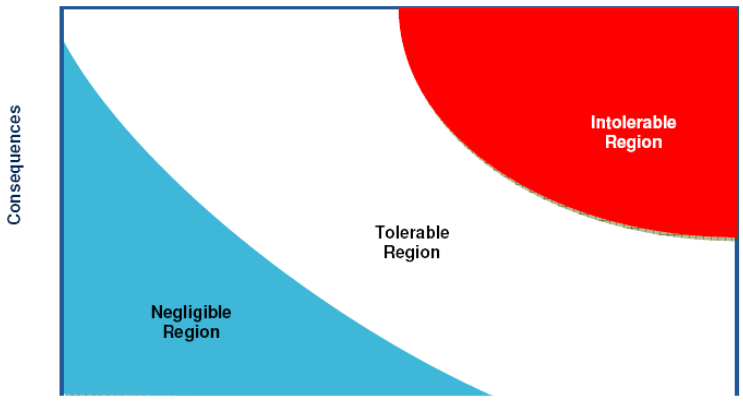


Fig (6) Model of Risk region Graphical Presentation
Source: INSB, 2010

4-3-4 F-N curves:

The F-N curve may be used in relation to risk acceptance for personnel environment and assets number of fatalities. The acceptance limit may be adjusted according to the resource, which is exposed. Moreover, the F-N curve used as an acceptance limit may reflect risk aversion to major accidents (with multiple fatalities), if the product of f and N is decreasing with increasing N. The calculation of values for the F-N curve is cumulative, i.e. a particular frequency relates to 'N or more' fatalities present an illustration. [Salem, 2008]

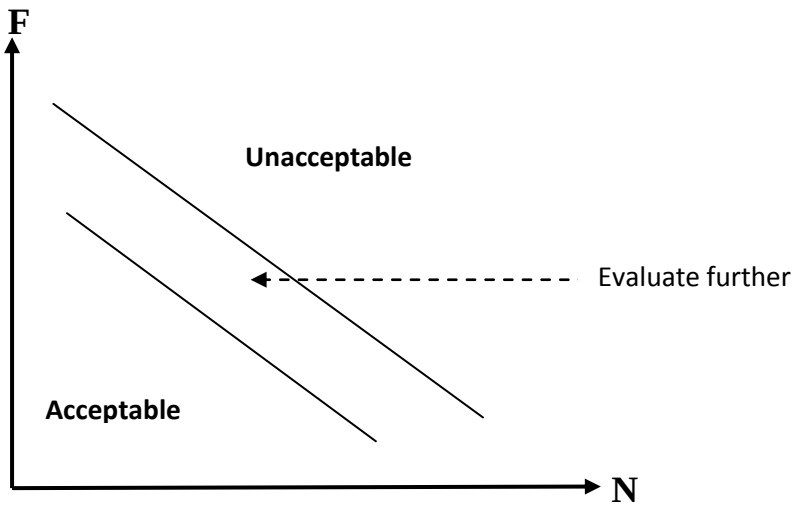


Fig (7) illustrates (F= frequency, N = number for measurement of consequence) expresses the acceptable risk level according to a curve where the frequency is dependent on the extent of consequences

Source: Salem, 2008

4-4 Phase 4: Risk Reduction and control:

The purpose of this phase is eradicating Hazards with intolerable risk at whatever cost. If this is not practicable abandoning the operation should be considered.

• Reducing the risk of those in ALARP region if it is cost effective. Higher costs could be considered acceptable if the risk is close to the intolerable region.

• Reducing the risk levels of those in the negligible region with minimal effort.

- Risk reduction methods could be categorized as:

1- Management Method: Methods based on development of a safety culture improved effectiveness of communication, training, etc.

2- Engineering Method: Incorporate additional engineering features to enhance safety

3- Operational method: Implementing/updating proper procedures

4- Combination of all of above. [GL, 2010]

4-4-1 The ALARP concept:

ALARP mean "as law as reasonably practicable", the ALARP principle used for risk acceptance is applicable to risk, personnel, environment, and assets. The risk level should be reduced as far as possible in the interval between acceptable and unacceptable risk. The common way to determine what is possible is to use cost-benefit evaluations as basis for decision on whether to implement certain risk reducing measures.

The upper tolerability limit is almost always defined, whereas the lower tolerability limit is sometimes defined and is in other cases left undefined. The lower limit is individual to each individual risk reducing measure, depending on when the cost of implementing each measure becomes unreasonably disproportional to the risk reducing effect Fig (8).
[Salem, 2008]

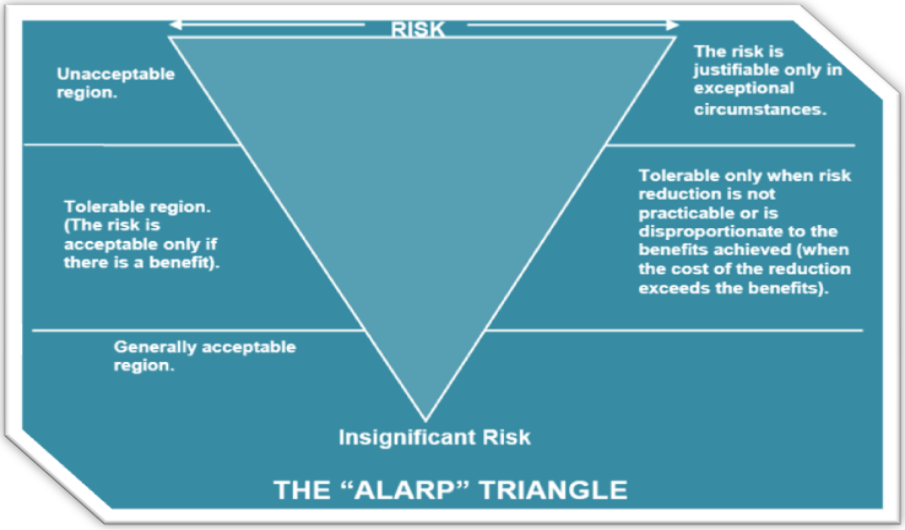


Fig (8) the ALARB triangle
Source: GL, 2010

4-4-2 Actions and the use of Timescale (risk level):

The table below fig (9) indicating the actions required and the timescale for response to treatment and reduce certain risks. Risk categories are the fundamental basis for determining whether improved control measures are required and the timescale for actions.

Risk Categories		Action And Timescale
LOW	Acceptable	No further additional controls / preventive and mitigative or alternative actions is necessary, but consideration should be given to cost-effective solutions or improvements that impose minimal or no additional cost. Monitoring is required to ensure that the controls are maintained.
MEDIUM	Tolerable	Efforts should be made to reduce risk, but the costs of prevention should be carefully measured and limited. Risk reduction measures should normally be implemented within a defined period of time.
HIGH	Intolerable	Work should not be started or continued until the risk level has been reduced and risk numbers enters the Yellow or the Green area. While the additional control measures should be cost-effective, the Company's duty to reduce the risk is absolute. If the control measures are not possible to reduce the risk, even with unlimited resources, then the work must not be started or must remain prohibited.

Fig (9) action and timescall
Source: INSB, 2010

4-5 Phase 5: Review of risk assessment:

4-5-1 Periodical review of risk assessment:

Shipping companies should periodically reviewed the Risk assessment to ensure that the applicability of existing procedures/conditions and periodicity may vary depending on the hazard level of the operation tasks or system.

Periodic reviews can help ensure consistency across risk assessments carried out by different people at different times. Where conditions have changed and/or better risk management technologies have become available, improvements should be made as necessary.

4-5-2 Evaluation of control measures:

The implementation of the new control measures should followed up, and recorded and evaluation of the controls should be made to ensure they remain in place and have the desired effect. Moreover, in case of accidents or near misses, the risk assessment should be reviewed to determine if a control /measure failed, a control is missing or new hazards are present.

4-5-3 Requirement for new risk assessment:

If there changes in materials, equipment, operations, procedures, and software, a new risk assessment should be carried out, the original risk assessment can be reviewed as a replacement for the performing of a new one, provided that nothing has changed and the applicability of the existing procedures is ensured. The shipping companies should be able to determine whether existing risk assessment are adequate or need improving, or if new controls and assessment are required.[Kristiansen, 2005]

4-5-4 Recording and documenting the results:

The proof of the change management process must be part of the ISM certification (during document verification, office audit and shipboard audits). Shipping companies should document and keep the results of hazard identification, risk assessments and determined controls. Because of Risk assessment is a part of the change process and therefore has to be documented, too.

The risk assessments records should be filed and organized under the SMS filing system in order to be easily retrievable otherwise there will be the need of repetitive assessments of the same operation and on the other hand there will not be the necessary objective evidence as may be requested by auditors, and PSC etc. [INSB, 2010]

5-The broadest concept of the total risk management system:

Risk management system considered a decision making aid, and a judgment process "whether a total risk is acceptable or not". The principal philosophy of this process is to

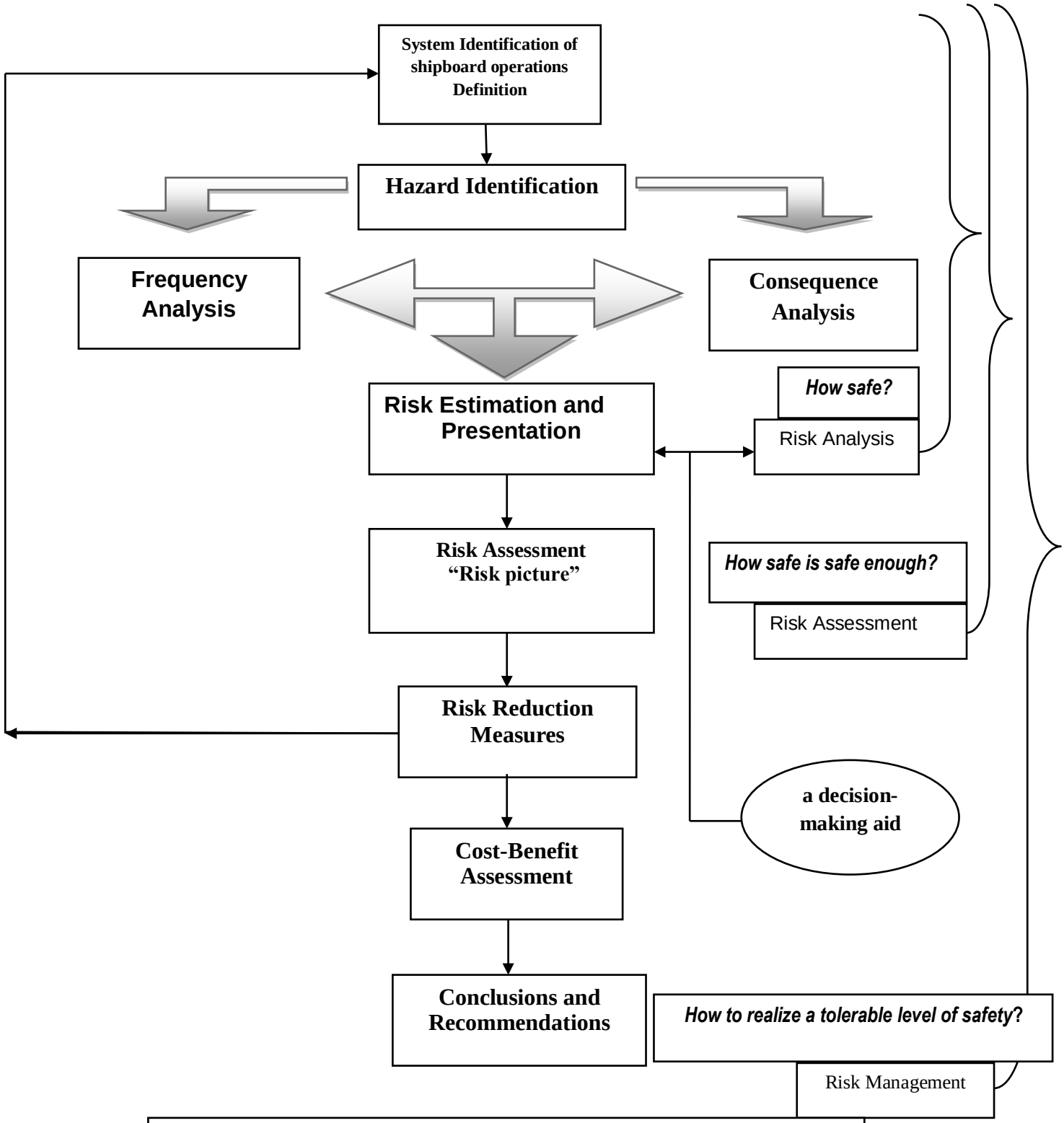


Fig (10), The Process of Risk Analysis, Risk Assessment and Risk Management

Source: IACS, 2004, Mullai, 2005

help in expanding the effective safety culture in shipping companies "ship operators" and on board ships, where the human element is given regular and effective consideration.

The purpose of risk management is to facilitate and embed a culture of continuous improvement in safety performance without the requirement for additional regulation. Moreover, it is the overall integrated process consisting of three essential interrelated and overlapping parts, and which is distinct from risk assessment, involves the key stages and steps shown below:

- Risk analysis and estimation
- Risk assessment
- Risk management and control.

Risk management system is also the process of assessing risk and developing strategies include transferring the risk to another party, avoiding (preventing) the risk reducing (mitigating) the negative effect of the risk, and accepting some or all of the consequences to as law as reasonably practicable (ALARP) of a particular risk. It should be noted that risk assessment forms are fundamental part of the total risk management process that is the ISM Code adopted for it means that it is fig (10). [Mullai, 2005]

Discussion:

"The development and implementation of a documented safety management system is an exercise in the total risk management process", therefore it is a significant matter to primarily understand the concept of risk assessment "the core of total risk management process". Moreover, the amendments made the risk assessment are essential to compliance with most of ISM code clauses.

Shipping companies "ship operators" are expected to provide evidence that the shipboard operational procedures are based on risk assessment. Since The ISM Code does not specify any particular approach to the management of risk and it is for the companies to choose methods appropriate to its organizational structure, its ships and its trades, that may affects the risk assessment process efficiency in increasing the safety management system

effectiveness and its standardizations as it is varies in risk assessment approaches, methods and opinions.

It is worth mentioning that top management level of shipping companies, ship operators, and ship's captains are need for glowing understanding of the techniques of risk assessment and it takes a time and requires a continuously training and progress's surveillance for the members involved by experienced persons to archive the optimum aims of ISM Code recent amendment to reduce the consequences or probability of occurrence.

References:

- American Bureau of Shipping ABS, (2004). "RISK ASSESSMENT APPLICATIONS FOR THE MARINE AND OFFSHORE OIL AND GAS INDUSTRIES", American Bureau of Shipping
- Antonio, Rodriguez.J,(2005). "The International Safety Management (ISM) Code: A New Level of Uniformity" Fowler, Rodriguez, Kingsmill, Flint, Gray, & Chalos, L.L.P., L.L.P. New Orleans, Louisiana, http://frc-law.com/publications/publications3.htm, cited on 13 June 2012, available on net.
- Arben, Mulley,(2005)."RISK MANAGEMENT SYSTEM – RISK ASSESSMENT FRAMEWORKS AND TECHNIQUES" Project partly financed by the European Union (European Regional Development Fund) within the BSR INTERREG III B programme, ISBN 951-564-393-7
- Bénichou Yung, D,(2003). "CONCEPTS OF FIRE RISK ASSESSMENT", Institute for Research in Construction (IRC), National Research Council Canada (NRCC), NRCC-46393, Canada.
- Germanischer Lloyd-GL, (2010). "Guideline for Risk Management" ISGOTT, IMO FSA MSC/Circ. 1023, http:// www.insb.gr, cited on 25 June 2012, available on net.
- Gordon, Halsey,(2010). "ISM, Risk Management and Motivation" http:// www.dnv.com, cited on 6th July 2012, available on net
- IACS, (2004). "Risk assessment Guideline", http://ebookbrowse.com/sol-045-iacs-risk-assessment-pdf-d312333410, cited on 1st July 2012 available on net.
- INSB Class,(2010). "Guide for Risk Assessment" ISM –ISPS Systems Dept, http:// www.insb.gr, cited on 12th July 2010
- ISM, Code. International Safety Management Code, amended, 2008,2010 rule (1.2.2.2)
- Kristiansen, Svein, (2005). "Maritime Transportation Safety Management and Risk Analysis" Elsevier Butterworth-Heinemann, UK , ISBN 07506 59998
- MSC, (2008). "AMENDMENTS TO THE INTERNATIONAL MANAGEMENT CODE FOR THE SAFE OPERATION OF SHIPS AND FOR POLLUTION PREVENTION" Annex 8 of the IMO resolution MSC.273 (85), http://www.imo.org/includes/blastData.asp/doc_id=11087/273(85).pdf , cited on 1st July 2012 available on net.
- Nomikos, Nikos.K,(2009). "Shipping Derivatives and Risk Management" PALGRAVE MACMILLAN, Great Britain, ISBN-10: 0–230–21591–2
- Salem, Ahmed,(2008)."MARITIME SAFETY&RISK MANAGEMENT" Faculty of Engineering, Alexandria University