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Task Risk Assessment While Conducting Deck Works

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Abstract:

Purpose: *This article provides an analysis of the risk assessment for a seafarer performing deck work. For this purpose, the hazards that negatively affect the increase in potential risk on the job and actions that can reduce them are presented.*
Design/Methodology/Approach: *The study was prepared on the basis of own experience and skills in preparing risk assessments and information contained in the studies standardizing the principles of work at sea and risk assessment methods.*
Findings: *For many years, OSH has been convinced that there are four fundamental pillars, to achive proper preparation and protection of the employee in the area of occupational health and safety. The first pillar is to develop appropriate habits in employees. The second is to control the working area, third pillar is proper maintenance of all kinds of documentation. The last pillar is Task risk assesment, whitch found to be the essential. Properly performed hepls to eliminate hazards that arise, and minimize those that remain unsolved*.
Practical Implications: *Proper organization of the workplace, adequate training, providing personal protective equipment, following norms for hours of work are very important aspects.*
Originality/Value: *Ensuring the safety of the employee while performing his duties is an essencial role of the employer.*

Keywords: *TRA, task risk assessment, deck works, safety.*

JEL codes: *R40, R41.*

Paper Type: *Case study*

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1. International Regulations Regards Safety

The nature of the work, the high number of hazards and the number of accidents convinced the authorities of the International Maritime Organization to introduce regulations requiring shipowners to prepare and implement solutions to improve living and working standards at sea.

On July 1, 1998, together with the addaptation of Chapter IX of the SOLAS Convention on the management for the safe operation of ships, the ISM Code became effective. It presents an international standard for the safe management and operation of ships and the prevention of pollution. The main goals of the introduction of the Code are to ensure safety at sea, to protect people from injury, to avoid environmental damage, particularly to the marine environment.

The most significant regulation introduced by the ISM Code is the obligation of the company to prepare and implement a Safety Management System, including the application of safety and environmental protection policy, preparation of instructions and procedures to ensure safe work on board and environmental protection. They must be in compliance with international and flag state regulations.

Human error is the dominant factor contributing to marine accidents (Harrald *et al.*, 1998, Toffoli *et al.*, 2005). Measures to prevent accidents at sea should focus primarily on the elimination of human error. Model studies based on the assessment of human reliability in Greek ship accidents were proposed by Tzannatos and Kokotos (2009). Besides, the impact of human factors within maritime safety management systems and structural damage was also studied by Er and Celik (2005; 2007).

2. Guidelines for Health and Safety of Work

Growing emphasis on providing safe and healthful working conditions has led to the idea that a way of managing occupational health and safety needs to be created. For this reason, in 1999 a set of requirements and guidelines was drawn up, after fulfilment of which the certification authorities would issue a certificate of compliance with these requirements. This norm was called OHSAS 18001: 1999, with Polish equivalent called PN-N-18001:2004.

The described standard assumes that the effectiveness of safety improvement requires that the activities in this respect "are carried out within the framework of a structured management system" implemented by the organization. The goal of this standard is "to assist in the improvement of occupational safety and health by specifying the requirements for an effective occupational safety and health management system". The standard has been prepared so that it can be applied by any organization. This norm is of vital importance in relation to the ship. On its basis, the Safety Management System required by the International Safety Management Code can be drawn up.

3. Methods of Risk Assessment

Regardless of the risk assessment method chosen, the use of each method is focused on achieving specific targets, which are:

- to identify work-related hazards and to estimate and determine the acceptability of the associated occupational risks and, consequently, to apply appropriate protective measures, taking into account the applicable legal requirements,
- check that the measures currently in place to protect against workplace hazards are adequate,
- prioritise action to eliminate or reduce risks where needed,
- demonstrate, both to workers and/or their representatives and to supervisor, that hazards have been identified and appropriate protective measures are in place to eliminate and/or reduce the occupational risks associated with the hazards,
- making an appropriate choice of workplace equipment, materials, and work organisation adapted to the psychological and physical capabilities of workers,
- ensuring that the applied collective and individual protection measures, as well as changes in technology and in methods and organization of work, undertaken with a view to reducing occupational risks, serve to improve the safety and health of workers (https://uslugi-bhp.com.pl/en/ryzyko-zawodowe).

To summarise the above goals for the risk assessment process we can say: systematically identifying, monitoring and examining the component parts of the work environment in such a way that risks are identified that could result in an accident, illness or ill health. It has to be determined if we are able to eliminate the described hazards, and if we are not able to do so, by what protective measures we can reduce the risk.

3.1 Risk Assessment Method According to PN-N-18002:2011

Risk assessment should be treated as a multi-step process and therefore it should be carried out step by step and then, after its interpretation, corrective and preventive actions should be taken if necessary. According to PN-N-18002:2011 risk assessment can be divided into the following stages:

a) Obtaining information necessary for risk assessment about the location of the workplace, the people involved (e.g., for a seafarer with an identified chemical allergy, criteria for task performance should be established), materials used and technological processes carried out, tasks performed (what task, how and when), legal requirements and standards relevant to the job description, hazards and their sources identified earlier, external hazards adversely affecting seafarer's health and safety, possible effects of previously identified hazards, previous near misses and accidents at work, occupational diseases or other health problems occurring after performing work in this or similar positions, activities of persons employed in

another position that may cause additional hazards, psychosocial conditions in the work environment, changes and their effect on the work area.

b) Hazard identification, which will result in the simplest and fullest possible identification of hazards present in the workplace, and identification of areas where additional expertise and testing should be conducted to confirm the presence of a hazard.

c) Risk assessment to determine the probability of occurrence of a hazard, severity of consequences. The probability of a hazard occurring is determined as follows: unlikely - the hazard should not occur during the entire period of employee's professional activity, probable - the hazard may occur no more than several times during the entire period of employee's professional activity, highly probable - the hazard may occur repeatedly during the entire period of employee's professional activity. The severity of consequences is defined as follows: low- injuries and illnesses that do not cause long-term discomfort and absenteeism from work, medium- injuries and illnesses that cause minor but prolonged or periodically recurring discomfort associated with short periods of absence, high- injuries and illnesses that cause severe and permanent discomfort and/or death.

d) Determination of risk tolerance is based on the requirements and applicable regulations and normative documents, based on criteria established by the organization. In case there are no regulations and/or normative documents, determination of risk tolerance is based on estimated risk.

The method described above belongs to one of the matrix methods - a specific indicator has a specific value assigned to it. Apart from it, in this group we can also find methods such as: PHA- Preliminary Hazard Analylis, JSA- Job Safety Analylis. They are based on similar assumptions as PN-N-18002:11.

3.2 ALARP Method

The ALARP- As Low As Reasonably Practicable method uses a common sense approach to the goal- we evaluate and apply risk reduction measures while making decisions about the level of risk. In reducing risk, we incur the economically reasonable costs required to reach the tolerable risk area.

The level of risk depends on many external factors, such as general environmental tolerance of accident events and losses, awareness of consequences for individuals and entire societies, social and professional groups affected by risk.

3.3 Risk Indicator Method-RISC SCORE[4]

[4] *W.T, Fine, Mathematical Evaluation for Controlling Hazards, Journal of Safety research, 3, 1971, s. 157- 166, cyt. za: https://www.pip.gov.pl/pl/bhp/ocena-ryzyka-zawodowego/o-ocenie-ryzyka-zawodowego/6264,krotka-charakterystyka-wybranych-metod-oceny-ryzyka-z-przykladami-zastosowan-.html, odczyt z dn. 10.04.2018.*

In the described method, risk is estimated with an indicator calculated from the formula (1):

$$R= SxExP \quad (1)$$

Where: S- possible effects (consequences) of the hazard
E- Exposure (exposure) to the hazard
P- probability of the occurrence of the incident.

The described method presents a the method of occupational risk assessment in an analytical way and by means of an appropriate indicator that gives the assessor a concrete view of the situation. Due to its methodology it is considered to be a frequently used method for risk assessment. As in the other methods, it is necessary to collect information on hazards and to make appropriate interpretations.

3.4 LMRA Method

LMRA- Last Minute Risk Assesment (hereafter referred to as "just before" Risk Assessment) appears to be one of the simpler and less demanding risk assessment methods. However, it requires an understanding of the need for each individual employee to use it. This is because in this method everyone is the "last line of defense" from a hazard. The LMRA is "a final and brief assessment of the workplace for health and environmental safety hazards".

The reason for using this method is to make sure that the hazards presented to the employee at his workstation have not changed or that no new hazards have appeared. The goal is to make sure that the job done in a while is safe. The most important point in using this method is to convince the worker that spending a few extra time on his own risk assessment will improve his safety considerably.

Each of the described methods can be used to assess the risk during shipboard work. From the shipowner's point of view, a convenient solution is to prepare the risk assessment on the basis of PN-N-18002:2011 standard according to a three-level scale, with appropriate documentation of this fact. This allows to meet the requirements of international law, and additional supplementation of the risk assessment by the LMRA method will improve the safety of seafarers when performing onboard duties.

3.5 HFACS Method

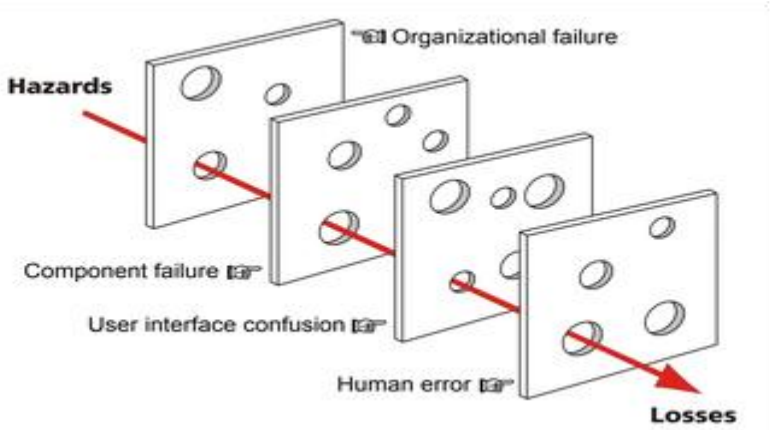
The Human Factors Analysis and Classification System (HFACS) identifies human causes of an accident and offers tools for analysis as a means of planning preventive training. It was developed by Dr Scott Shappell of the Civil Aviation Medical Institute and Dr Doug Wiegmann of the University of Illinois at Urbana-Campaign in response to a trend that showed that some form of human error was a major causal factor in 80% of all Navy and Marine Corps aviation accidents (Reason, 1990).

HFACS is based on the swiss cheese model of human error, which analyses four levels of human failure, including unsafe actions, preconditions for unsafe actions, unsafe supervision and organizational influences.

Due to the usefulness of HFACS in accident analysis, various applications of HFACS have emerged over the past decades and its framework has been slightly modified and improved.

The theory of the HFACS method has been successfully applied in various sectors such as medicine and surgery, road traffic, rail traffic, mining, construction industry and maintenance. In contrast, the adaptation of HFACS applications in the marine industry is quite limited. Celik and Er (2007) modified the HAFCS framework to identify the impact of design-based system errors on human factors at sea (Figure 1).

Figure 1. *Swiss cheese model for human error causation*



Source: Https://en.wikipedia.org/wiki/Human_Factors_Analysis_and_Classification_System

3.6 SHELL Method

The SHELL model is a conceptual human factors model that explains the range of human factors in aviation and helps to understand the human factors relationship between the aviation system's resources/environment (the flying subsystem) and the human component of the aviation system (the human subsystem).

The SHELL model was first developed by Elwyn Edwards (1972) and later modified into a 'building block' structure by Frank Hawkins (1984) and Hawkins and Orlady, (1993). The model takes its name from the initial letters of its components (software, hardware, environment, liveware) and emphasizes the human and human interfaces with other aerospace system components.

The SHELL model adopts a systems perspective, which suggests that humans are rarely, if ever, the sole cause of an accident. The systems perspective takes into

account a number of contextual and task-related factors that interact with the operator within the aviation system, affecting operator performance. As a result, the SHELL model takes into account both active and latent failures in the aviation system.

It is very important to understand that people do not interact perfectly especially in the different circumstances they may encounter in the working environment. They are likely to react in the same way in the aircraft cabin. To avoid tensions in the model it is necessary to harmonize each element in relation to each other. By putting the crew - the people - inside, it can be said that the components need to be properly matched to the people. SHELL is very useful to show the interrelationships between the various parts of an aviation safety system.

4. Factors that Generate Risks when Performing On-board Work and How to Control Them

Methods described in the previous chapter are aimed at reducing the likelihood of an incident hazardous to the life and health of a worker. For its occurrence, however, a certain catalyst is necessary, which we call a factor. The most popular classification of factors is hazardous, harmful and noxious. The first group may be called hazardous factors, that is, factors whose action on a person may contribute to injury.

In the performance of deck work threatening the seafarer with dangerous factors or their source, acting suddenly and being at the same time physical factors. In the case of physical factors, and where a proper risk assessment has not been made, we can talk about an accident at work, which is a sudden event caused by an external cause, which results in injury or death.

The second group of factors are harmful and anxious. We recognize such factors as those that, if they affect a seafarer for a longer period of time, are likely to cause a decrease in his physical and mental condition. In the long-term perspective they may also cause a worsening of the state of health, and in the long run - chronic diseases caused by the work performed.

The presented division, especially when it comes to distinguishing hazardous factors and harmful and noxious factors, is conventional. While the occurrence of one of the dangerous factors, in extreme conditions, will most likely lead to injury, and to a lesser extent to the occurrence of occupational disease, long-term exposure to factors from the second group will contribute to its occurrence. However injury may occur in the emergency of a harmful or noxious factor.

5. Task Risk Assessment While Performing Deck Work

Job characteristics:

1. Tools used: power tools (grinder, hand saw, jigsaw, welding machine), hand tools (hammer, chisel, spanner), shovels, brushes.

2. Materials used: paints, solvents, sanding discs, rags, etc.
3. Tasks performed: ship maintenance, watchkeeping, cargo operations.
4. Hazardous, harmful and noxious working environment factors: variable weather conditions, extreme weather conditions, noise, sharp tools, high pressure installations, machinery, dust and dirt.
5. Personal protective equipment used: safety boots, boiler suit, goggles, gloves, face shield, breathing apparatus.
6. Legend:
   P- Probability of occurrence,
   C- Severity of consequence,
   R- Risk,
   L- Large,
   M- Medium,
   S- Small.

The most common hazards found during deck works and means of mitigation shows Table 1, where to make TRA the Polish Standard PN-N- 18002:2004 has been used.

6. Conclusions

The main task was to conduct a risk assessment analysis for the main deck work. In accordance with the theory presented in one of the chapters that it should be as simple as possible and give appropriate results, a three-stage method of risk assessment contained in Polish Standard PN-N- 18002:2004 was selected. This matrix allows for a simple and accurate task risk assessment. With same accuracy as Risc SCORE this method seams to be simpler.

The third method (ALARP), is considered as one of the faster and simpler ways to assess risk. The problem of this method is its accuracy and the costs that an employer would have to face when implementing solutions resulting from its use.

The last method described, LMRA, in practice should not be used as the single indicator of risk level. It is primarily used to assess whether the conditions described in the work instructions have changed just before the task begins.

When performing a task risk assessment, regardless of the work performed, it is not possible to eliminate fully possible risk. This is because at any point in time between completion of TRA and job commencement, there could appear a new factors that cause risk.

Control and evaluation of the work allows us to build awareness about situations where possible risk should be mitigated. Taking time to go trough whole TRA brings us closer to cortol the performance of work in safe manner.

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