

FRI-20.21-1-SITSTL-05

---

## TANKER SHIP RISK ASSESSMENT PROPERTIES <sup>5</sup>

---

### **Assoc. Prof. Dobrin Milev, PhD**

Department of Operation and Management of Maritime Transport  
“Nikola Vaptsarov” Naval Academy  
Phone: +359 895 742374  
E-mail: d.milev@nvna.eu

### **Yordan Dimitrov Dimitrakiev**

Department of Operation and Management of Maritime Transport  
“Nikola Vaptsarov” Naval Academy  
Phone: +49 176 23172688  
E-mail: ydimitrakiev@gmail.com

**Abstract:** *The purpose and the scope of the formal risk assessment on board tanker ships is to support shipping company's activities and operation by applying risk management and internal control policy. Furthermore it helps stimulating the risk and control awareness by encouraging employees to talk about risk and how it is managed. Assisting the development of risk management process, using a common and simple approach is the risk assessment main goal.*

*The nature and technical characteristics of the ship are essential for the identification of the hazards that have to be considered when developing the risk assessment forms. They represent a plan-do-checks related to the operational particularities of the tanker ships. That's why the tanker ship management senior officers are involved in the elaboration of actual and precise forms covering all the operational properties. The shipping company has the final word by approving and ensuring that all the safety measures are taken on board ships, thus implementing a common policy.*

**Keywords:** *Tanker ship, shipping company, risk assessment, hazards, safety*

### Application

The Formal Risk assessment describes a plan-do-check improve loop which relates to the management of risk.

The Plan element comprises of five steps:

Definition of the work and the environment that the Shipping Company (SC) operates;

Objectives and intention for accomplishment;

Risk identification;

Association of risks with the desired objectives;

Identification of actions to confront these risks.

The above steps describe a "Risk based internal control framework" - this framework has to be sustained by implementing it, checking it whether it is effective and continuously improve it. [5]

### Responsibilities

The SC had made a suitable and sufficient identification of hazards to which the crew is exposed as a result of the normal day to day operation and activities on board and ashore.[7]

These hazards are identified as follows:

---

<sup>5</sup> Докладът е представен на пленарната сесия на 24 октомври 2025 г. в секция Sustainable and Intelligent Transport Systems, Technologies and Logistics, с оригинално заглавие на английски език: Tanker Ship Risk Assessment Properties

Shipboard operations - Engineering operations, Commercial, Political, Managerial;

The SC must ensure that measures are taken to ensure improvement in the safety and health of the crew members with respect to those risks identified by the assessment, as well as with other risks associated with the above hazards;

The existing management systems should be adopted and integrated with the risk assessment principles, taking into account the nature of the operation, the type of the hazards and the associated risks ashore and onboard;

The Formal Risk Assessment is prepared to meet industry's needs as an integral part of the SC's day to day operation, to be simple and easily understood and to be cost effective (ALARP principle - As Low As Reasonable Practical);

Assessments are subject to revisions and changes should be conducted if necessary;

SC Office and ship personnel should be informed if such changes occur;

All work activities should be considered from a risk assessment standpoint.

Risk assessment

This is the process that determines where a hazard will be located on a risk scale. It normally comprises intolerable, tolerable and negligible regions. (Fig.1)

Hazard - The potential to cause undesirable events;

Risk - A measure of hazard's significance involving simultaneous examination of its consequence and probability of occurrence;

Residual Risk - The risk remaining after applying all risk-mitigation measures and controls.

A means to determine how much risk reduction should be done and whether possible solutions are cost effective. For example if the reduction in risk level is insignificant compared to the cost of implementing the proposed solution, it would not be reasonably practicable to go ahead.[6]

Controls - They are every procedure identified in the SC's SQEMS (Safety, Quality, Environment Management system) as well as everything purported by the Industry's Best Practice and the International Regulations, directly leading to the containment of the specific sub-hazard;

Likelihood - It is the means of assessing how likely is a sub-hazard to occur despite all the controls in place;

Exposure - It is the means of assessing how exposed is the SC to the Operation or Activity under discussion;

Consequence (Loss Injury Level) - It is the consequences that the Company shall suffer should the sub-hazard actually Occurs. The consequences are associated either with human losses or incidents;

Risk Level (Risk Class Index - RCI) - It is a numerical figure which represents the classification of the associated risk per each sub hazard under consideration. The overall Risk Level (RCI) for the whole activity or operation is the maximum of the Risk Levels (RCs) derived. Depending on the figure applied, certain steps have to be taken or not as applicable;

Routine and Non-Routine Jobs - "Routine Jobs" are described as works that are contained in the Risk Assessment Manual and "Non Routine Jobs" (or New) are these that are not contained in the Risk Assessment Manual and therefore a Risk Assessment is required.

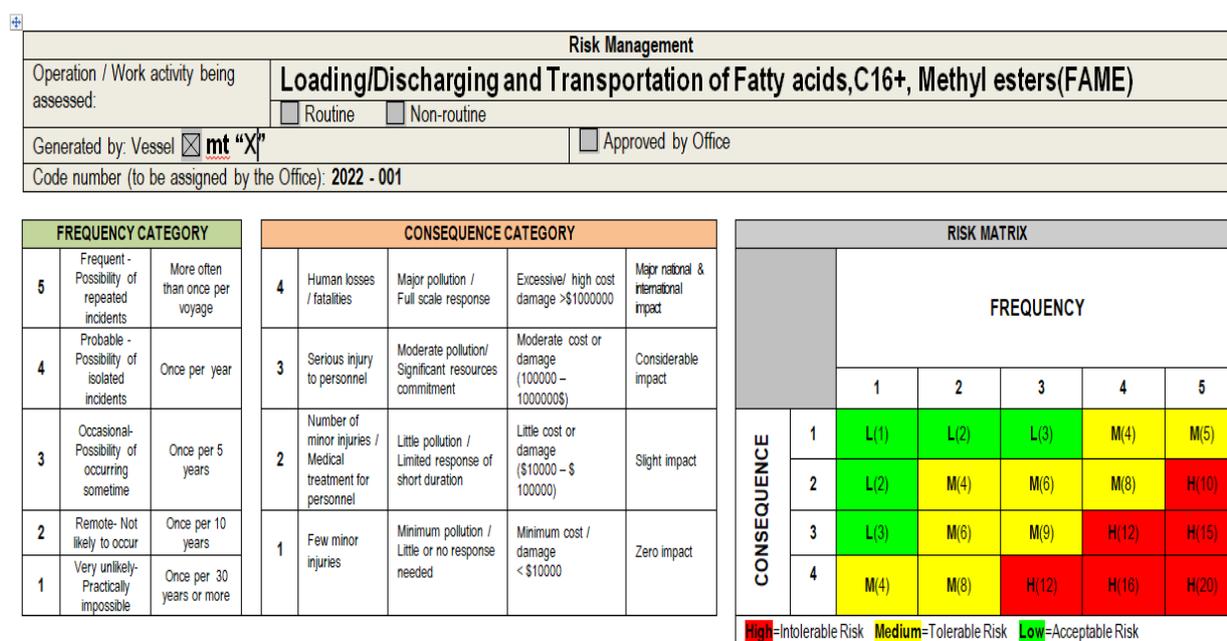


Fig.1. RA Matrix, Frequency and Consequence Category

### Procedures

The SC has a risk management based approach, designed to render reasonable assurance on the day to day operation ashore and on board so as to meet objectives set forth in Company's management system policy.

A Risk Assessment is a careful examination of what, in the nature of operation can cause harm, in order to take measures/control/precautions to prevent such harm.

The assessment should be simple and easily understood. Such an assessment must be related only to risks which arise directly from the work activity being undertaken and which has the potential to harm persons involved, the environment or the property. This specific assessment is not extended to any other consequential peril, resulting from the particular work activity. Assessment should first establish the hazards at the place of work and then identify the risks out of the work activity. (Fig. 2)

The process of the assessment should not be overcomplicated, which means that the exercised efforts should be focused on the level of the risks identified and whether those risks are controlled by satisfactory precautions and or procedures bearing in mind the ALARP principle.[1]

Risks assessment should be seen as a continuous process. In practice the risks in the work place would be assessed before work begins on any task for which no valid risk assessment exists. An assessment should be reviewed and updated as necessary to ensure it reflects any significant changes of equipment or procedures.

Risk Assessment						
Risk Identification			Risk Analysis	Initial risk evaluation		
No	Hazard	Potential hazardous event	Existing control measures	F	C	R
1	Loading / Discharging the wrong tanks and / or cargo leaks	Little poll/cost or damage	Check hourly all tanks, pump-room, coffer-dams, overboard valves & confirm that cargo is loaded/discharged to / from designated cargo tanks.	1	2	2
2	Wrong loading/discharging rates.	Moderate pollution/cost or damage	Check tank ullages hourly & calculate load/discharge rate. Compare volumes & rates with shore figures to detect discrepancy.	1	3	3
3	Loss of stability or excessive stress during loading or discharging	Little poll/cost or damage	Verify load/discharge plan hourly, ensuring that stress & stability remains within allowable limits. Inform cargo officer any deviations.	1	2	2
4	Tank, pipeline or hose leaks.	Minimum poll/ cost or damage	Monitor pressure drop & compare tanker & terminal cargo quantity transfer figures. Stop operation & investigate discrepancies.	2	1	2
5	Undetected overboard cargo leaks during night hours.	Little poll/cost or damage	During darkness, where safe and practical, the water around the vessel should be illuminated.	1	2	2
6	Tank topping off sooner than anticipated.	Moderate cost or damage	The loading/discharging rate should not be substantially changed by terminal without informing the ship.	1	3	3
7	Lack of communications when topping off	Moderate cost or damage	Before topping off operations commence at an offshore berth, the ship/shore communications system must be tested.	1	3	3
8	Tank overflow when topping off.	Little poll/cost or damage	Where possible, the completion of loading/discharging should be done by gravity. If pumps have to be used to the end, their delivery rate during the 'standby' time should be regulated so that shore control valves can be closed as soon as requested by the ship.	2	2	4
9	Cessation of loading/discharging by terminal.	Little poll/cost or damage	Inform terminal timely to be in 'stand by' for stopping its pumps, as agreed in SSSCL.	1	2	2
10	Uncontrolled flow during topping off.	Moderate poll/ cost or damage	Advise the terminal when the final tanks are to be topped off & request timely to reduce the loading/discharging rate to control the flow.	1	3	3
11	Timely closing of valves.	Moderate poll/	Close shore control valves before the ship's valves. Reduce the number of valves during topping off to a	1	3	3

Fig.2 Risk identification and initial risk evaluation

A risk assessment plan should contain the following to which all the findings should be recorded: [2]

- Work activity;
- Hazards (sub hazards);
- Controls in place;
- Crew eligibility– fitness (nesting technique);
- Likelihood of harm;
- Exposure.

Assessment should cover risk arising from the SC and vessels activities. Crew members should report any significant finding of their risk assessment, as well as any new assessment (Non-Routine) undergone for any new activity which is not included in the SC's assessment inventory. Furthermore reporting must include Assessments with Risk Class index greater than 4.

Risk assessment is addressed to the four senior officers who have the responsibility of assessing risks for the rest crew members who may be affected by their activities. The SC Office will coordinate such assessment. The process of risk assessment should be carried out by experienced personnel (senior Officers). Experience should be gained through in house SC's seminars, briefing, de-briefing and on boarding training. Such training should be extended to the rest crew members who should have the sense of a risk to learn to live with this new perception acting always proactively and not reactive.

Risk Treatment				Residual risk evaluation		
Hazard No.	Additional Risk Control Measures	Responsible	Action Timeline	F	C	R
17	a. Isolating valves of the tanks which will be depressurized for measurement sampling etc should be closed and locked	C/O	Prior to operation	1	4	4
	b. Tank depressurization should be effected slowly in order to avoid the hazardous gases to be directed with force on deck while ship board personnel are present.	C/O	Prior to operation			
	c. Ensure that measurement or sampling equipment is in good condition.	C/O	Prior to operation			
	d. A plan for undertaking the work should be developed, discussed and agreed by all who have responsibilities in connection with the work. This plan should also include safety measures/arrangements.	Master	Prior to operation			
	e. A Safety Meeting should be carried out prior to the work with the participation of all involved personnel with the aim of reviewing safety measures to be followed. During this meeting it should be ensured that all health and safety hazards related to cargo carried are made available to the involved personnel prior commencement of the operation. The relevant MSDS should be used.	Master	Prior to operation			
	f. Ensure that appropriate personal protective equipment, if necessary, are put in place before starting the operation.	C/O	Prior to operation			

Note F: Frequency, C: Consequence, R: Risk

Fig.3 Additional risk control measures

#### Daily works – planning and execution

As the Formal Risk Assessment (FRA) is tightly related with the daily on board activities, it shall be taken under Consideration during the Planning and Execution of all routine and non-routine operations. In order to serve this purpose and in an effort to formalize and unified the recording of Jobs Planning and Execution, a common Form has to be developed by the SC.

#### Form description and completion

This form consists of four main columns. The first one is separated into two rows, one of the Job Planning date and the other of the Execution date (which normally shall be the next date of the Planning). The Work Description column contains a very brief explanation of the planned operation. For convenience and uniformity purposes it is recommended to refer to the FRA Manual and to the "Activity" field which covers a wide spectrum of routine and non-routine operations. Activities and jobs that are not mentioned in the Manual but are - or could be- part of daily works (i.e. cleaning of forecandle, engine room or accommodation internally, painting on deck etc.) must also be recorded. Two rubber Stamps, one for the Chief Engineer and the other one for the Chief Officer (C/O) are escorting this Form. These Stamps shall be utilized on the Third column of the form (Risk Assessment Reference). Into the free space of the stamp the responsible Officer must insert the RA sheet code number covering the specific work or activity. In case of more than one planned activity, it is recommended to utilize all the available space of the row controlling thus the creation of multiple forms. The respective RA sheets and control measures shall be taken into consideration as it will safeguard crew and vessel against a potential exposure to threats derived from a routine and/or non-routine operation. (Fig.3) [3]

These rubber stamps with the respective reference of the RA will be placed also to every working permit available on board. (i.e. Enclosed space, Hot work, Working aloft etc.) will be stamped and the RA Sheet will be mentioned. [4] The Forth column is divided to five sub-columns. The Senior Officers responsible for the job planning and execution and RA implementation must sign the form. In the fifth column the person participating and/or supervising the planned work must sign too. Depending on the work this person can be the Third/Forth Engineer or Electrician for Engine room works, and Second/Third Officer or Pump man / Boatswain for Deck works.

The form shall be completed separately for Deck Jobs and Engine Room Jobs. However during the Planning meeting (where these Forms will be completed) the four Senior Officers will have a general knowledge of the pre-planned activities. This "Helicopter View" will be a valuable tool in the safe execution of all works as it will reduce the risk of a potential mishandling and miscommunication. (i.e. Steam release from the funnel while funnel painting works were in progress).

#### Form Filling and Dispatching

The Persons filling and maintaining the completed forms will be the Chief Engineer and the Chief Officer respectively. Records will be maintained on board for two years.

The form will be dispatched to the SC Office (Safety and Quality or Technical Department respectively) at the end of every month and will accompany the "Daily Overtime Record". It shall be presented to third parties (i.e. Inspectors, Auditors etc.) and it would be also face evidence that Formal Risk Assessment techniques have been taken under consideration during the planning and execution of a routine and a non-routine operation on board.

#### Conclusion

The RA is playing an important role in the maritime safety as the shipping industry requires strict measures in the on board operations. The ship tankers could be extremely dangerous if safety measures are not taken well in advance and having in mind all the consequences that could arise of under estimating the operational hazards. All the tanker ship characteristics must be implemented and considered when

elaborating the optimal risk assessment process. Thus, all the risks will be covered and all the consequences predicted on the way of improving the safety education.

## REFERENCES

Andales, J., (September 17, 2025), How to perform a risk assessment, available at <https://safetyculture.com/topics/risk-assessment>

Dasgupta, S., (July 14, 2019), Risk assessment for ships: A general overview, available at <https://www.marineinsight.com/marine-safety/risk-assessment-for-ships-a-general-overview/>

IMO ISM Code Risk assessment lessons, (2025), available at <https://www.seably.com/courses/risk-assessment/lessons>

ISGOTT (2020), 6th Edition, OCIMF

ISM Code (International Safety Management Code), (2018), IMO (International maritime organization)

Shipowners club, (October 17, 2016), Implementing risk assessments, available at <https://www.shipownersclub.com/latest-updates/news/implementing-risk-assessments/>

Singh Banga, B., (February 7, 2017), What is risk assessment and why it is so useful on board, available at <https://www.myseatime.com/blog/detail/what-is-risk-assessment-and-why-it-is-so-useful-on-board>