Ventilation

Motor Room

OFF START

Machinery Room

OFF START

Water Curtain OFF START

EMERGENCY SHUTDOWN Activate

SIGTTO Society of International Gas Tanker & Terminal Operators Ltd

Liquefied Gas Cargo Resource Management Course

First Edition

Human Element Series

Liquefied Gas Cargo Resource Management Course

(First Edition)

SIGTTO

The Society of International Gas Tanker and Terminal Operators (SIGTTO) is a non-profit making organisation dedicated to protect and promote the mutual interests of its members in matters related to the safe and reliable operation of gas tankers and terminals within a sound environment. The Society was founded in 1979 and was granted consultative status at the International Maritime Organization in November 1983.

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Introduction and Scope

1   Introduction and Scope

1.1   Introduction

Human factors is about people and their interaction with machines, procedures, equipment and other people. Crew resource management aims to optimise the safety performance of people when they are working together as a team.

Information on the background of crew resource management can be found in UK Civil Aviation Authority (CAA) publications CAP 719[1] and CAP 720.[2] These publications provide ready access to the original documents, which were published as International Civil Aviation Organization (ICAO) Digests. The concept of resource management has been developing since the 1980s and is now recognised as a valuable tool for safety management in the aviation and maritime industries.

In the maritime industry, crew resource management is specified under STCW[3] and is called bridge resource management (BRM) for navigation activity and engine resource management (ERM) for engine room activity.

Although crew members often receive BRM and ERM training, safety critical operations can be more dynamic and demanding in the cargo control room (CCR). This document provides recommendations for cargo resource management (CRM) training courses to improve the safety of liquefied gas cargo operations.

CRM enables safe cargo operations by using all available resources, including the crew, equipment and relevant information. The risk of incidents during cargo operations can be reduced through appropriate CRM training.

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[1] UK Civil Aviation Authority – CAP 719 - Fundamental Human Factors Concepts

[2] UK Civil Aviation Authority – CAP 720 - Flight Crew Training: Cockpit Resource Management (CRM) and Line-Oriented Flight Training (LOFT)

[3] IMO – International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)

1.2   Scope

This document is written at a level suitable for organisations involved in CRM training in the liquefied gas shipping industry. It provides guidance for training institutions, as well as ship owners and operators that provide resource management training.

The CRM training courses covered in this document are designed for officers and other shipboard personnel engaged in liquefied gas cargo operations.

2

Course Overview

2 Course Overview

2.1 Objectives

A CRM training course aims to optimise the performance of personnel engaged in cargo operations. This includes improving communication, situational awareness, teamwork and workload management.

Topics covered in a course include:

- Planning and execution of cargo operations
- CCR organisation and procedures
- behaviour of an effective cargo team
- ways to modify behaviour to achieve a safe team culture
- lessons learnt from past incidents
- identification of critical operations.

After completing a course, trainees should be able to demonstrate familiarity with:

- The necessary knowledge and skills for safe cargo handling
- fundamental understanding of CRM
- precautions to prevent incidents
- non-standard operations
- contingency planning and response.

2.2 Participants

The suggested optimal capacity for a course is six trainees. This may vary depending on the conditions of the simulation exercises and the amount of individual attention the instructor can provide each trainee.

Trainee groups should consist of an actual ship CCR team, including a mix of participants from the following ranks:

- Captain
- Chief Officer
- 1st Officer
- 2nd Officer
- 3rd Officer
- Cargo Gas Engineer.

When a complete team is used, the scenarios are more realistic and opportunity for discussions from different perspectives is enabled. This improves the value of a course for the participants.

3

Course Structure

3   Course Structure

It is recommended that a CRM training course uses a variety of delivery styles, including presentations, videos, case studies and simulation exercises to encourage discussion and participation.

A course should be held in a facility with space for both lessons and simulation exercises. A typical format is to hold lessons in the morning session so that the knowledge learnt can be practiced during simulation exercises in the afternoon session. Example lesson plans are provided in Section 3.3.

The exact content of a course may be modified according to:

- Findings from internal and external audits and assessments
- lessons learnt from incidents
- training or assessment requirements of the company or training centre.

The simulation exercises used should be based on the requirements in *Maritime simulator systems*,[4] or similar.

3.1   Trainee Preparation

All trainees should be provided with preparation material before a course. Lesson material may include, but is not limited to:

- Topics to be covered during a course
- survey questions for trainees to answer in advance
- checklists in preparation for exercises based on human behaviour
- case studies of relevant incidents.

Simulation exercise material may include, but is not limited to:

- Cargo operation manual to be used in the simulation exercises
- details of the ship to be used in the simulation exercises
- other simulation exercise notes.

3.2   Course Delivery

Instructors should brief trainees at each lesson and simulation exercise to explain the purpose, learning objectives and any assessment criteria. Before starting simulation exercises, instructors should explain that the exercise will not replicate the exact conditions found in an actual CCR.

Time should also be allocated for debriefing after lessons and simulation exercises. This can include referring to closed-circuit television (CCTV) footage or instructor notes to encourage trainees to examine their own performance critically. Reflecting on self-performance after each cargo operation is part of the continuous improvement process.

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[4] DNV GL – ST-0033 - Maritime simulator systems

3.2.1 Lessons

Lessons should be conducted by an instructor in a two-way communication style. The venue should be suitable for the number of trainees and should be equipped with facilities, such as whiteboards and projectors, to aid the delivery of a course.

Resource management video recordings, such as CCTV incident footage from CCRs and human behaviour training videos, should be used to highlight examples of the training outcomes.

3.2.2 Simulation exercises

Simulation exercises are designed to improve trainees' awareness of hazards while completing cargo operations. They allow trainees to operate in a risk-free environment and gain more experience in safe and efficient cargo operations.

The simulation exercises should be conducted to enable trainees to behave naturally, as if they were on a real ship, so they can demonstrate normal behaviour and attitude. The exercises should replicate the behaviour of cargo, equipment and their control systems, including malfunctions and non-standard conditions, with realistic alarms.

Simulation exercises should include an instructor station, a CCR and a deck area. The instructor station should be isolated from the CCR while still allowing communication with trainees. Trainees should not have access to instructor facilities.

The CCR area should have workstations with multifunctional displays and communications equipment that replicate a CCR in a modern liquefied gas carrier. This will allow for realistic simulation of cargo handling, monitoring and interface with the terminal.

The deck area should include, but not be limited to:

- Manifold watch
- trunk deck
- mooring station
- compressor and motor room
- gangway.

Simulation exercises should cover, but may not be limited to:

- Cargo control system
- ballast control system
- tank and pipeline arrangements
- cargo machinery equipment
- boil-off gas (BOG) management equipment
- emergency shutdown (ESD) and alarm system
- use of trend graphs
- internal and external CCR communication system
- stability and stress calculator
- custody transfer measurement system (CTMS), or equivalent.

3.3   Example Lesson Plans

Table 1 provides three days of example lesson plans that may be included in a CRM training course. Morning lessons are followed by afternoon simulation exercises to reinforce the topics covered.

These lesson plans are intended as guidance only and should not be considered as a definitive list.

Session	Example topics
Day 1	
Morning lesson	Resource management as a concept: ▪ Effective resource management ▪ teambuilding and leadership ▪ CCR team organisation ▪ effective handover of the Watch ▪ alarm management ▪ relevant case studies. Human factors and performance: ▪ Situational awareness ▪ best practices ▪ alertness ▪ prioritisation ▪ distraction management ▪ resilience.
Afternoon simulation exercise	Liquefied Gas Cargo Handling Simulator (LGCHS): ▪ Presentation by the instructor in the simulator ▪ ship and cargo handling specifics ▪ delegation of duties ▪ cargo operational checklist use. Scenarios to use: ▪ Bringing the ship to live condition ▪ 24 hours pre-port preparations ▪ load port preparations for arrival. Exercise debriefing topics: ▪ Identify areas for improvement ▪ team communication ▪ allocation of tasks and roles.

Day 2	
Morning lesson	Communication: • Effective planning • standard operating procedures • operations rules, chain of errors • feedback • briefing • debriefing.
Afternoon simulation exercise	Commence loading, ramp up: • Simulator start condition should be ship alongside, connected with all pipelines and arms cooled down • start loading, ramp up • bring to maximum loading rate. Loading cargo with maximum rate: • Simulator start condition should be cargo loading at full rate, all tanks open, vapour handling and deballasting in progress, all ancillary systems in normal operation, no alarm conditions • transfer in charge position from C/O • cargo handling maximum loading rate by Officer of the Watch (OOW) • handover Cargo Watch. Complete loading, ramp down: • Simulator start condition should be at maximum loading rate, approaching completion of cargo 30 minutes before reducing loading rate, deballasting may or may not be complete, OOW in charge and Chief Officer (C/O) called • handover the Watch • transfer responsibilities to C/O. Exercise debriefing topics: • Identify areas for improvement • team communication • allocation of tasks and roles • management of alarms • use of remedial actions, monitoring and double-checking.

Day 3	
Morning lesson	Non-standard conditions: • Short-term strategy • leader in emergency • rules for abnormal and emergency situations • crisis management.
Afternoon simulation exercise	Commence discharge: • Simulator start condition should be ship alongside, connected with all pipelines and arms cooled down • start discharge • bring to maximum discharge rate. Discharge of cargo with maximum rate: • Simulator start condition should be at full rate, all tanks open, vapour handling in progress, ballasting may be in progress, all ancillary systems in normal operation, no alarm conditions • transfer in charge position • cargo handling maximum discharge rate by OOW • handover Cargo Watch. Complete discharge: • Simulator start condition should be at maximum discharge rate, approaching completion of cargo 30 minutes before reducing discharge rate, ballasting may or may not be complete, OOW in charge and C/O called • handover the Watch • transfer responsibilities to C/O. Exercise debriefing topics: • Identify areas for improvement • team communication • allocation of tasks and roles • maintenance of situational awareness • reaction to developing trends • recovery from non-standard conditions.

Table 1: Example lesson plans

3.4   Post-course Assessments

If assessments are a part of a course, it is recommended that assessors are independent of the course's training staff.

3.5   Additional Course Material

In addition to the recommendations provided in this document, the following sections of STCW[5] can be considered:

- Bridge resource management
- engine room resource management
- leadership and managerial skills
- application of leadership and team working skills
- basic and advanced training for officers for liquefied gas tanker cargo operations
- guidance regarding the use of simulators.

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[5] IMO – International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)

Annexes

Annex 1 – Glossary of Terms and Abbreviations

BOG   Boil-Off Gas

BRM   Bridge Resource Management

C/O   Chief Officer

CAA   Civil Aviation Authority

CCR   Cargo Control Room

CCTV   Closed-Circuit Television

CRM   Cargo Resource Management

CTMS   Custody Transfer Measurement System

ERM   Engine Resource Management

ESD   Emergency Shutdown

ICAO   International Civil Aviation Organization

IMO   International Maritime Organization

LGCHS   Liquefied Gas Cargo Handling Simulator

OOW   Officer of the Watch

STCW   Standards of Training, Certification and Watchkeeping for Seafarers

Annex 2 – Reference List

- UK Civil Aviation Authority – CAP 719 – Fundamental Human Factors Concepts
- UK Civil Aviation Authority – CAP 720 – Flight Crew Training: Cockpit Resource Management (CRM) and Line-Oriented Flight Training (LOFT)
- IMO – International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)
- DNV GL – ST-0033 – Maritime simulator systems