gas as a marine fuel

Bunkering of ships with Liquefied Natural Gas (LNG) competency and assessment guidelines

technical

safety

contractual

training & competence

environmental

Training & Competence

version 2.0 **FP04-02**

sgmf

the society for gas as a marine fuel

Version 2.0, September 2017

ISBN number: 978-0-9933164-5-6

Disclaimer

While the advice given in this "Bunkering of ships with Liquefied Natural Gas (LNG) – competency and assessment guidelines" has been developed using the best currently available information, it is intended solely as guidance to be used at the owner's own risk.

Acknowledgements

This document was produced by SGMF's Working Group on Training & Competence. SGMF acknowledges the participation of the following individuals and companies in the development of this document.
Alan Campion (minus 161 consulting), Thierry Chanteraud (Total), Ray Gillett (GTT Training), David Haynes (Society for Gas as a Marine Fuel), Robin Jackson (Videotel), Ivan Lim (Keppel Shipyard), Stefan Molin (Skangas), Forkanul Quader (UK Maritime and Coastguard Agency), Daniel Perera/ Bob Sanguinetti (Gibraltar Port Authority), Swapan Das Sarma (ECM Maritime), Guozheng Shi (China Class), Adrian Tuck (Tuxan Consulting), Fokke van der Veen (Hereema Marine Contractors) and Jaime Bleye Vicario (Centro Jovellanos).

Foreword

Within risk management, it is generally acknowledged that by providing operatives with the information and skills that they need to undertake a task safely and efficiently, the lower the perceived risk will be. LNG has been carried at sea for over 50 years with an enviable safety record, thanks to the design of the vessels used, the use of common standards and protocols, along with skilled personnel engaged in all stages of the process.

The use of LNG as a fuel on marine vessels is a new and growing sector which is introducing some different and challenging factors which need consideration. The LNG in this context will be used as the fuel of the vessel, not the cargo. Consequently the transfer of LNG in bunkering operations may receive less focus than has traditionally been expected with LNG as cargo. In addition the transfer operations may take place in a variety of locations, using various methods, from different types of suppliers, again a very different environment to what has been used in the LNG shipping industry to date.

However, as many are aware, LNG when not handled correctly can be hazardous due to its very low temperature and its flammability properties. Consequently to reduce the risk to acceptable levels all personnel engaged in its handling need to be educated and trained accordingly so that they have the competence required. The training required for the actual facilities (i.e. terminals, trucks, supply vessels, receiving vessels) is defined by the responsible industry and authorities. However, as in any situation where an interface is required between two systems to allow an operation to take place there is an increased risk. For the use of LNG as a fuel, not only because of the interface but all the differing factors that will have to be considered, it is generally acknowledged that the bunkering process is the area that is going to pose the greatest risk.

In compiling this document and methodology we have attempted to define a simple but common approach that focuses on the tasks that have to be performed to ensure the successful completion of a transfer of LNG from a supplier to a receiver. The aim is that the suggested guidelines can be used by any individual, organisation or authority, on either side of the transfer process to identify what tasks will be conducted

by themselves, their personnel, or within their scope and hence be able to identify the knowledge, understanding and competencies that they require. In so doing we have also tried to ensure the guidelines are simple to understand and interpret. Trying to develop a simple scheme that can be applicable to all the various parties that may be involved has not been an easy task, but I believe this document goes a long way to meeting that goal and for that I have to thank the hard work undertaken by the contributors to the working group and those that have provided comments separately.

The overall goal is to ensure that any transfer of LNG will be completed safely and effectively, no matter where, when or how.

The use of LNG as a fuel is a new industry that will develop and hence new knowledge, understanding and competence requirements will no doubt be identified. It is therefore the intention that this document will be reviewed and be updated accordingly and on a regular basis and to this end SGMF and the Training & Competence working group in particular would welcome any comments and suggestions for its improvement.

Ray Gillett
General Manager,
GTT Training Ltd

Introduction

This publication aims to provide guidance to all parties who may be directly or indirectly involved in the bunkering of ships with Liquefied Natural Gas (LNG), regarding the standards of competency which should be expected of those persons involved to ensure that bunkering is completed safely, effectively and in an environmentally responsible fashion.

These guidelines recognise that the bunkering process involves different organisations, both ashore and afloat, whose training and competency cultures may be significantly different. The competency framework developed aims to ensure that all persons have the same knowledge and understanding no matter the method by which the training may be delivered and thereby ensure a common standard across all interested parties, who may include (whilst not necessarily being limited to):

- ship owners, managers and personnel working for them on the LNG fuelled/receiving vessel
- drivers and operators of LNG road tankers or containerised LNG tanks
- LNG bunkering terminal staff supplying LNG direct to gas fuelled vessels
- bunker vessel owners, managers and personnel working for them on the LNG supply vessel
- port managers and staff including shore based personnel of ship owners working within ports in close proximity to LNG bunkering operations
- local and national authorities that need to approve and/or regulate bunkering infrastructure
- local emergency services personnel who need familiarity to allow them to design/manage emergency response plans
- third parties visiting or delivering to/from LNG fuelled vessels in port areas
- academics developing and delivering training courses for all the parties involved

The competency framework has been developed on several levels to ensure that staff with different roles, responsibilities and levels of exposure to LNG can each achieve the appropriate levels of knowledge about this relatively new area of activity.

The purpose of this document is to define the competence requirements in the undertaking of each task. How persons obtain the relevant competencies and hence the format of the training that will be provided will vary depending in which sector of the industry they are working. However the use of a modular approach is suggested, allowing individuals to progress through the competency framework as their knowledge and job role requires, and their experience develops. These guidelines have drawn from a wide range of initiatives and competency requirements covering the practices required within bulk LNG operations on LNG carriers, via a LNG import terminal and road tanker procedures, to the filling of LNG fuelled trucks, and the principles published by IMO and other authorities that will support the operation of gas/LNG fuelled ships. SGMF has drawn on the wealth of experience and expertise of its members, both in the handling of LNG and the various training programs that have previously been implemented, to produce a comprehensive set of guidelines to which the industry can refer.

The initial sections of this document cover the nature and philosophy behind the training and competency framework. The main body of this document lists competence areas within which individual elements are identified. The underpinning knowledge intended to support the training is also described, although in less detail. This combination is intended to ensure that personnel understand the appropriate actions to be taken, the reasons why they are appropriate and the implications of the actions. The final sections of this document present the competency modules in an alternative form centred on each functional role to make it easier to identify which modules are appropriate to the individuals concerned.

Contents

Definitions and Abbreviations

A&E – Accident and Emergency; a hospital or other urgent casualty care department. Sometimes referred to as a casualty department

ADN – European agreement concerning the international carriage of dangerous goods by inland waterways (Accord Européen Relatif au Transport International des Marchandises Dangereuses par Voies de Navigation Intérieures)

ADR – European agreement concerning the international carriage of dangerous goods by road (Accord Européen Relatif au Transport International des Marchandises Dangereuses par Route)

Agreement to bunker – is the process of following a formalised procedure agreed by all parties, ideally supported by a check list to ensure that LNG transfer takes place safely and in an environmentally acceptable manner

Apply – in this document means apply concepts, general rules and their knowledge to different but limited situations in their work place

ATEX – European Directive concerning protection of workers from the dangers of explosive atmospheres (Appareils destinés à être utilisés en ATmosphères EXplosibles)

BOG – Boil Off Gas, the vapour created by the evaporation of part of the LNG

BLEVE – Boiling Liquid Expanding Vapour Explosion, an explosion resulting from over pressurising a liquid gas storage tank usually as the result of a fire beneath the tank

CCNR – Central Commission for Navigation of the Rhine, the body that controls regulations on the major international inland waterways of Europe

CCTV – Close Circuit TeleVision, a means of monitoring an area remotely using cameras and TV screens

CH_4 – Methane, a hydrocarbon that is the main constituent of natural gas

Closed Questions – a question with a limited number of answers to choose from, for example a multiple choice test

CNG – Compressed Natural Gas is natural gas that is stored at high pressure (up to 300 bar)

CO_2 – carbon dioxide, a combustion product. A major greenhouse gas

Competence – indicates being capable of undertaking a task and completing it successfully with confidence and understanding

Cryogenic – temperatures less than -100°C (typically)

Custody transfer – in this document, refers to the formal agreements and associated legal and other documents related to the transfer of LNG from supplier to receiver

Custody transfer measurement – is defined by the American Petroleum Institute (API) as providing *'Quantity and Quality (Q&Q) information used for the physical and fiscal documentation of a change in ownership and/or a change in responsibility for commodities'*

Duty of care – requires employers/owners to take all steps which are reasonably possible while performing any acts that could foreseeably harm the health, safety and wellbeing of personnel, property or the environment

Emergency Shut-Down (ESD) – Emergency Shut Down, a control system and its components that when activated stops operations in a controlled manner and returns the system to a safe state

An ESD system may have several sequential stages, operation of each stage dependant on the potential consequences of the situation. During bunkering these stages are commonly designated ESD-1 and ESD-2.

ESD1 – where transfer of LNG to the bunkering vessel is stopped

ESD2 – where the transfer system is disconnected from the bunkering ship

In some ship types there may be additional definitions to the ESD system but these are outside the scope of this document.

Facilities – in this document refers to the land or ship based components of the bunkering system which could include the LNG road tanker or container, an onshore terminal, the receiving vessel or a bunker vessel

GIIGNL – an industry group made up of the main LNG importers worldwide (Groupe International des Importateurs de Gaz Naturel Liquéfié)

HSSE – common acronym for Health Safety Security and Environment

IGC Code – the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk. IMO publication regulating ships used for carrying all liquefied gases in bulk as cargo

IGF Code – The International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels

IMO – The International Maritime Organization, the United Nation's maritime regulatory body

Interpret – in this document means critically examining information to make judgements, interpret novel situations, plan procedures and troubleshoot events

ISM – the International Safety Management Code published by IMO

ISO – International Organization for Standardisation an international standard-setting body composed of representatives from various national standards organizations

Know – in this document means recall learned information, particularly underpinning knowledge, on request

Knowledge – indicates possession of information relating to an event or operation that gives the individual the capability to safely take part in that operation. (See also Understanding)

LEL/LFL – Lower Explosive/ flammable limits, the lowest concentration of a flammable hydrocarbon in air that can be ignited and burnt. Similarly UEL/ UFL are the upper limits of the flammable range

LNG – Liquefied Natural Gas. Natural gas that has been cooled to the point where it is liquid at the current pressure. GNL in French, Spanish and Italian (French Gaz Naturel Liquefié)

LNGC – LNG Carrier, a specialist ship carrying LNG as a cargo in bulk

LPG – Liquid Petroleum Gas, a

mixture of propane and butane used as fuel and chemical feedstock

MARPOL – the International Convention for the Prevention of Pollution from Ships published by IMO

Mechanical handling – is the method and/or equipment used to manoeuvre the LNG transfer system into place and may consist of a crane or simpler devices such as block and tackle, chain hoists, etc

MSDS – Material Safety Data Sheet which provides workers and emergency personnel with procedures for handling or working with that substance in a safe manner, and includes information such as physical data, toxicity, health effects, first aid, reactivity, storage, disposal, protective equipment, and spill-handling procedures

Natural gas – a mixture of hydrocarbon gases, mostly methane, used as a fuel. May refer to natural gas in liquid or gaseous phase. A greenhouse gas

NPSH – Net Positive Suction Head, the absolute pressure at the suction port of the pump

OCIMF – Oil Companies International Marine Forum, an association representing operators of oil tankers and terminals dealing with safety and environmental issues and specifically associated with mooring and berthing guidelines

Open Questions – a question with no defined answers requiring candidates to consider and compare/contrast, for example an essay

P&ID – Process & Instrumentation Diagram, a drawing that shows all the main pipework, valves and instruments and how they are connected to each other

PIC – Person In Charge, sometimes also called the Person in Overall Advisory Control (POAC)

PPE – is a common abbreviation for Personal Protective Equipment

Q & Q – an abbreviation for Quality and Quantity, used to refer to specialist measurements taken as part of the transfer process

RPT – Rapid Phase Transition, the very rapid vaporisation of LNG into vapour through contact with a heat source, typically water

SGMF – Society for Gas as a

Marine Fuel, London based association for companies involved in the use of LNG as a marine fuel

SIGTTO – the Society of International Gas Tanker and Terminal Operators; an association representing operators of gas tankers and import and export terminals dealing with all liquefied gases in bulk

SIMOPS – Abbreviation referring to SIMultaneous OPerations; typically operations carried out on or close to a vessel at the same time as LNG bunkering

STCW – Standards of Training Certification and Watchkeeping. IMO publication detailing the standards and training for mariners on different ship types

Training – indicates teaching a particular skill or way of doing something

UEL/UFL – Upper Explosive/ flammable limits, the highest concentration of a flammable hydrocarbon in air that can be ignited and burnt. Similarly LEL/ LFL are the lower limits of the flammable range

Underpinning knowledge – is the minimum level of technical or other appropriate knowledge and understanding required to be able to carry out a task safely and efficiently without undue risk or delay.

Understand – in this document means understand the meaning and interpretation of instructions and problems based on the knowledge learnt

Understanding – indicates possession of sufficient breadth and depth of knowledge and experience to be able to make appropriate decisions about the preparation for, and conduct of an operation without compromising the safety or efficiency of that operation. (see also Knowledge)

VCM – Vinyl Chloride Monomer, highly volatile liquefied gas used to create PVC (polyvinyl chloride) for moulded plastic products

1. Purpose and Scope

This guide provides a summary of the recommended competence guidelines for the supply and bunkering of LNG for marine vessels, and the environment (for example the port), in which these LNG transfers take place, together with knowledge that underpins them. In identifying the competencies due account has been taken of the existing industry best practices and expertise.

There are many tasks involved in the use of gas as a marine fuel, often involving personnel both ashore and afloat. This document is therefore designed to be applicable to all the personnel who may be involved in carrying out the required tasks regardless of their background or location.

Note, these guidelines only cover the bunkering/transfer operation and are aimed to dovetail with and augment, rather than replace, other industry training schemes such as:

- STCW training for mariners on LNG fuelled ships
- STCW training for mariners serving on board IGC compliant vessels
- local or national training schemes for LNG road tanker drivers, for example ADR in Europe
- various systems for LNG bunkering terminal staff.
- guidelines issued by the respective bodies who may be engaged in the industry

This guide has been produced by the Society for Gas as a Marine Fuel's working group on Training & Competence.

The Society for Gas as a Marine Fuel *(www.sgmf.info)* has been established as a framework organisation covering the emerging gas as a marine fuel sector by working with other industry bodies, governmental and intergovernmental agencies, including IMO, within which both best practice and creative solutions can be reviewed and developed.

ISBN Number: 978-0-9933164-5-6

£250