



## 2024 LNG as a Bunker Fuel - LNGF (3 Days)

This LNG as a Bunker Fuel training course explains everything you need to know to ensure you are up to date with this exciting new development in the marine sector.

This three day course will enable you to make early and confident assessments of why, how and what LNG as Fuel (LNGF) will mean to you and your terminal or port.

Whether you are involved in new terminal to market LNG as Bunker Fuel or existing terminal planning a LNG Bunkering Setup we will guide you through the technical and commercial aspects of the decision making process. It is based on the latest publications by the Singapore Standards Council 2017-2020.

This course is aimed at LNG Bunker Surveyors Jetty Operators, Jetty Supervisors, Loading Masters, Ship & Barge Operators, Terminal Operators and Technical Management. If you are considering the advantages and disadvantages of using LNGF this course is for you. Moving from LNG Import and re-gasification to selling LNG in Liquid form to ship's using it as a fuel is a major investment in both time and money and this course will give you the tools to make the transition as smooth as possible.

### What will you learn?

By the end of this course you will be able to:

- Supervise and execute LNG Bunkering Quality and Quantity Control, Surveys and Inspections.
- Explain the legislative and commercial drivers for using LNG as Fuel
- evaluate the hazards related to LNG usage and handling
- Recognize the relevant regulatory acceptance by countries, port authorities, IMO and classification societies

- review design issues for marine gas fuel installations, including high pressure and low pressure gas supply systems
- determine the critical technical issues regarding design, fuel storage, bunkering and operation
- demonstrate an awareness of risk assessment methods to evaluate alternative design

## Inhoud

2021 LNG as a Bunker Fuel - LNGF (3 Days) .....	1
What will you learn? .....	1
SESSION 01 – INTRODUCTION FOR THE USE OF LNG AS FUEL.....	3
SESSION 02 – LNG PROPERTIES AND GAS LAW REVISION .....	3
SESSION 03 – HAZARDS OF LNG.....	4
SESSION 04 – REGULATIONS.....	4
SESSION 05 – LNG CONTAINMENT SYSTEMS .....	5
SESSION 06 – BUNKER DELIVERY METHODS.....	5
SESSION 07 - LNG BUNKERING CHECKLIST TR56-PART 3 .....	6
SESSION 08 – BUNKERING SAFETY CONSIDERATIONS .....	6
SESSION 09 – THE BUNKERING OPERATION - PROCESS .....	6
SESSION 10 – TYPES OF GAS FUELLED ENGINES .....	7
SESSION 11 – MANAGEMENT OF LNG FUEL TANKS .....	7
SESSION 12 – QUANTITY AND QUALITY MEASUREMENT .....	8
SESSION 13 – EMERGENCY RESPONSE .....	8

## SESSION 01 – INTRODUCTION FOR THE USE OF LNG AS FUEL

### **Understand where natural gas comes from & transportation**

- Natural gas constituents
- Processing natural gas
- Composition and energy content relationship
- Transporting natural gas by pipe or by ship
- Main exporting and importing countries, NG reserves

### *Why use LNG as a fuel?*

- MARPOL Annex VI why is it needed?
- Background to MARPOL Annex VI
- Overview of Annex VI
- Regulation 13 NOx
- Regulation 14 SOx
- Compliance Options

### *LNG Fueled Vessels Facts & Figures*

- Vessels Fueled by LNG
- Small scale LNG infrastructure development
- Environmental emissions comparison

TR 56 PART 1 General Introduction to LNG Bunkering

## SESSION 02 – LNG PROPERTIES AND GAS LAW REVISION

### **Composition of natural gas**

- Differences in load port compositions
- Effect of different compositions
- Physical properties of the components

### *Relationship between pressure and temperature*

- Saturated vapour pressure
- Relationship of SVP with temperature
- Boiling
- Change of boiling point with temperature

### *How LNG is kept cold*

- Evaporation and boiling in a tank
- Dropping pressure to cool liquid

### *Natural gas vapor*

- Vapor density
- The visible white cloud
- Difference between a vapour and a gas

### *Flammable range of natural gas*

- Flammable mixtures in air
- Flammable range diagram

### *Managing tank atmospheres*

- Inerting to avoid a flammable atmosphere

- Gas freeing to avoid a flammable atmosphere

*Other properties of Methane*

- Flash point
- Auto ignition temperature

## SESSION 03 — HAZARDS OF LNG

*Low Temperature*

- Cold burns and frostbite
- Liquid and vapor effect of ship structures
- Brittle fracture

*Pressure*

- In tanks
- In pipelines

*Flammability*

- Flammable range in a vapor cloud
- Ignition of a vapor cloud
- Ignition of a cloud from a vent mast
- Burn back of ignited clouds
- Vapor cloud explosions, detonation and deflagration
- BLEVE

*Sloshing in membrane tanks*

- In large LNGCs
- In small fuel tanks and bunker vessels

*Rollover*

- Stratification of layers
- How it may occur

## SESSION 04 — REGULATIONS

**Current regulations status**

- SOLAS statement on low flashpoint fuels

*Rules for bunker vessels*

- The IGC code

*Rules for vessels using LNG as a marine fuel*

- The IGF code
- Evolution of the IGF code
- IMO interim guidelines for LNG as a fuel
- Crew training requirements
- TR-56 SINGAPORE STANDARD
- SGMF LNG Bunkering Safety Guidelines.
- Proposed amendments to STCW
- National regulations for inland waterways
- Additional guidance – SGMF
- TR56- PART 4 Competence and Roles performed by Personnel Involved in

## LNG Bunkering Operation.

### SESSION 05 — LNG CONTAINMENT SYSTEMS

#### **Tank types approved by the IGC code**

- Independent tanks, A,B,C and Membrane tanks

#### *Type A tanks*

- Description of tank type
- Main characteristics

#### *Type B tanks*

- Description of tank type
- Main characteristics

#### *Type C tanks*

- Description of tank type
- Main characteristics

#### *Membrane tanks*

- Membranes generally
- NO96 description
- MkIII description

#### *Options for bunker vessels*

- Examples of small scale LNGCs with type C & membrane
- Comparison of size and weight differences

#### *Tank location requirements*

- Requirement for greater volume
- Draft IGF code requirements
- Examples of membrane and type C tank usage

### SESSION 06 — BUNKER DELIVERY METHODS

#### **TR56 PART 2 LNG BUNKERING**

#### Requirements for Custody Transfer

#### **Methods of bunker delivery**

- Pipe, truck or barge to ship
- container swap out

#### *Bunker station and hose requirements*

- Draft IGF requirements
- Dry disconnect couplings
- Emergency release system
- Emergency shutdown

#### *Management of pressure during the bunker transfer*

- Factors to consider
- Pressure and temperature relationship
- Typical tank pressure settings
- Membrane to membrane transfer
- Type C to membrane transfer
- Membrane to type C transfer

- Type C to type C transfer
- Keeping cargo cold in a bunker vessel

## SESSION 07 - LNG BUNKERING CHECKLIST TR56-PART 3

Exercise to fill and Understand Annex A LNG Bunkering checklist by participating Delegates.

Annex B Examples of Hand Signals for Bunkering Communication

Annex C Determination of Safety Zones

Annex D Discuss Emergency Scenarios with Participants

## SESSION 08 – BUNKERING SAFETY CONSIDERATIONS

### **Organisation**

- Master
- Person in charge

### *Communications*

- Receiving vessel and bunker supplier
- Verbal & non verbal communications
- Hand Signals as per TR56.

### *Hazardous areas*

- Definition of the hazardous area
- Electrical equipment in hazardous areas

### *Cryogenic protection Controlling sources of ignition*

- Potential sources of ignition
- Static electricity
- Galvanic currents

### *PPE*

- Protective clothing
- Resuscitators and BA

## SESSION 09 – THE BUNKERING OPERATION - PROCESS

### **LNG Bunkering Procedure and Safety Distances as per TR56 PART-3**

#### **Before bunkering**

- Compatibility
- Safety
- Checklists
- Weather
- Lighting
- Authorizations/Notifications
- Maximum filling level

### *Hose connection*

- Connection
- Purging
- Leak testing

*During bunkering*

- Supervision
- Starting
- Bulk transfer
- Topping off
- Filling Limits
- Vapour management

*After bunkering*

- Post transfer checklist
- Draining and purging of hoses
- Disconnection of hoses

## SESSION 10 — TYPES OF GAS FUELLED ENGINES

### **Propulsion systems using gas fuelled engines**

- Electrical and mechanical systems
- Fuel gas delivery pressures

*Basic principles of gas fueled engines*

- Pure gas engines
- 4 Stroke dual fuel engines
- 2 stroke dual fuel engine HP and LP gas injection

*Knocking and methane number*

- Cause of knocking
- Problems caused by knocking
- Methane number and relationship to knocking

## SESSION 11 — MANAGEMENT OF LNG FUEL TANKS

### **Gas fuel management and delivery systems**

- Requirements of stored fuel systems
- Main components in delivery system
- Example of Wartsila LNGPac for LP delivery
- Example of HP gas delivery system

*High fuel demand*

- Delivery of BOG gas to engines
- Generation of additional gas

*Low fuel demand*

- Delivery of BOG gas to engines
- Dealing with excess BOG

*Bringing a tank into service*

- Inerting
- Gassing up
- Cooling down

*Taking a tank out of service*

- Removal of liquid



- Warming up
- Inerting
- Aerating

## SESSION 12 – QUANTITY AND QUALITY MEASUREMENT

### **Understand the requirement to measure quantity and quality**

- Recognize that LNG traded on energy content which varies with evaporation
- Discuss the variability of LNG composition around the world
- Understand the need to pay for what is received and the taxes due
- State the requirement to know the Methane Number for engine performance

#### *Quantity measurement*

- List the measurement options
- Describe a Coriolis Mass Flowmeter
- Describe an Ultrasonic Flowmeter
- Describe the way in which density is determined

#### *Quality measurement*

- Recognize the issues associated with taking a sample of LNG liquid
- Describe the way in which samples may be taken
- Discuss the use of gas chromatography in determining composition of samples

## SESSION 13 – EMERGENCY RESPONSE

### **Leaks**

- Detection
- Response
- Protection from low temperatures
- Use of water spray to deflect gas clouds

#### *Venting*

- Location of vent mast
- Vapor cloud dispersion
- Lightning strike

#### *Fighting Gas Fires*

- Fire-fighting equipment
- Techniques for fighting gas fires
- Use of dry powder





TTT Instructor : Capt. Shyam Paliwal

- Experienced, proven, entrepreneurial maritime leader with record of high achievement and proactive approach to excellence who welcomes challenges as an opportunity to excel and recognizes that the satisfactions of accomplishment far outweigh the burden of leadership:
- 12 continuous years of successful hands-on problem solving and decision making experience in challenging, dynamic and multifaceted marine work environments at sea and ashore, in position of responsibility or other crucial decision-making leadership capacity.
- 7 years as senior officer aboard deep-draft LNG Tanker vessels transporting volatile cargoes in the world-wide liquid gas trade, with an unblemished safety record and outstanding personnel evaluations.
- 5 Years work experience at LNG and Oil Tanker Terminals in Korea in capacity of LNG advisor to Shell Shipping and Trading Company. Commissioned the 4 largest LNG carriers in the world the Q-Max vessels at LNG Import terminals in Korea. Each vessel is an LNG terminal on it's own with a Re-Liquefaction plant and an enclosed Flare.
- Supervised Building of 25 Oil and LNG Tankers at Samsung, Daewoo and Hyundai Shipyards in Korea as a Nautical Inspector while working for Shell in South Korea.
- 2 Years work experience as LNG consultant with Tank Terminal and Training Netherlands.
- Provided LNG marine operations, safety, and regulatory compliance consulting services to major energy and marine transportation companies.
- Significant shore side operations management experience with broad knowledge of commercial aspects of global maritime enterprise and energy shipping.
- **Master Mariner License IFOO-8700 from Government of India. Member of Nautical Institute UK.**
- LNG simulator training from Various Institutes worldwide Including Warsash Maritime Academy UK, and NYK Maritime Training Centre Yokohama.

*We make people better!*