



# THE CHEMICAL ENGINEERING MAJOR

## Liquefied Natural Gas (LNG) Cargo Operations and Re- liquefaction

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## **Introduction**

The Liquefied Natural Gas (LNG) industry is very much a growth industry with both demand and supply likely to continue to increase in the short to medium term. Much shore-based activity depends on the expedient and safe operation of the LNG tanker. Office-based staff have little opportunity to engage with sea staff and even less to be given a comprehensive understanding of ship-board operations.

This BTS training course incorporates the activities and concerns of the LNG tanker within the context of a dry dock to dry dock cargo cycle. Beyond this, each aspect of design and safe operation, including the operation of relevant machinery and equipment and the physics of LNG re-liquefaction will also be covered and included.

### **This training course will highlight**

- The properties and hazards of handling LNG
- How design can enhance safe operation of LNG tankers
- The stages of a cargo cycle
- Preparation for dry dock and the first cargo after dry dock
- Measures to protect the commercial interests of an LNG tanker owner

## **Training Objectives**

### **What are the Goals?**

#### **By the end of the training course, participants will learn to:**

- Identify the hazards of LNG
- Understand safe design and safe operations
- Recognise the stages of a cargo cycle
- Protect the commercial interests of the tanker owner
- Understand the specialist techniques for fighting an LNG fire

## **Target Audience**

### **Who is this Training Course for?**

This BTS training course will be suitable for a wide range of professionals but in particular:

- Energy company oil and gas process managers and operators
- Energy company oil and gas plant managers and operators
- Sales and marketing managers
- Financial directors
- Project managers
- Investment analysts
- Asset managers
- Asset engineers
- Ship and voyage managers
- Ship superintendents
- Cargo surveyors and expeditors
- Ships' staff

## **Training Methods**

### **How will this Training Course be Presented?**

Participants on this training course will receive a thorough grounding in the subjects listed in the seminar outline utilising a variety of presentational techniques in order to facilitate learning in the most expedient manner. Lectures will be punctuated with filmed footage, practical, theoretical and group exercises and classroom discussion. Case studies chosen specifically to demonstrate the application of theoretical principles will be provided. Question and answer sessions will conclude each formal lecture.

# Daily Agenda

## Day One: The Application of Regulation and Mitigation of Hazard

**Competency Description:** By the end of day one, participants will be able to apply the relevant codes and regulations to LNG tankers and be aware of the properties and hazards of handling LNG cargo. They will also be able to distinguish between hazardous and non-hazardous zones on a tanker and how design can complement best practice to ensure safety and efficiency in the transportation and delivery of cargo.

### Key behaviours

- Apply relevant IGC Code regulations to LNG carriers
- Identify the properties and hazards of LNG
- Understand how design can contribute to safety
- Distinguish between hazardous and non-hazardous zones
- Determine how to control sources of ignition

### Topics to be covered

- Regulations
- Properties and hazards of LPG
- Design for safety
- Hazardous and non-hazardous areas
- Sources of ignition

## Day Two: Atmosphere Control and the Physics of LNG during a Re-liquefaction Cycle

**Competency Description:** By the end of day two, participants will have been introduced to the chemistry and physics of LNG and the physical processes undergone to capture vapour for re-liquefaction. The mechanisms of both inert gas generators and nitrogen generators will have been covered in addition.

### Key behaviours

- Understand the physics and chemistry of LNG cargo
- Recognise the components of an inert gas generator
- Recognise the components of a nitrogen generator
- Anticipate the behaviour of LNG
- Understand the processes of LNG re-liquefaction

### **Topics to be covered**

- Physics and chemistry
- Inert gas generators
- Nitrogen generators
- Behaviour of gases
- LNG Re-liquefaction and cargo conditioning

## **Day Three: Types of LNG Tanker and Cargo Tank**

**Competency Description:** By the end of day three, participants will be familiar with the regulatory categorisation of both ship and tank types, their construction and the means of maintaining the cargo in liquid form. The commercial interests of the ship owner, will be featured, in terms of reliable quantification of LNG cargo.

### **Key behaviours**

- Identify types of LNG carrier
- Understand the IMO categorisation of LNG carriers
- Recognise different tank types and construction
- Understand the mechanism and performance of cargo pumps
- Identify different methods of level measurement

### **Topics to be covered**

- Types of LNG carrier
- IMO ship types
- IGC Code damage assumptions
- Tank types and construction
- Cargo pumps
- Level measurement

## **Day Four: Safe Working Practices and the Preparation for the Cargo Cycle**

**Competency Description:** By the end of day four, participants will be able to identify correct procedures for preparing and testing the atmosphere of dangerous spaces for entry. They will have started assessing the preparations required to start the cargo cycle, in particular preparations for the first cargo after dry dock.

### **Key behaviours**

- Understand procedures for safe entry to dangerous spaces
- Identify the mechanism of operation of gas detection instrumentation
- Identify the stages of a cargo cycle
- Apply preparative procedures for loading
- Understand the requirement for gradual cooling of tanks and lines

### **Topics to be covered**

- Dangerous space entry
- Gas detection instrumentation
- Cargo operational cycle for LNG tankers;
- Preparation for first cargo after dry dock
- Gassing up and cooling down

## **Day Five: The Cargo Cycle and Personal Protection**

**Competency Description:** By the end of day five, participants will have completed coverage of the entire cargo cycle and be able to assess the procedures and precautions to be taken at each stage. They will also understand the preparations to be made for dry dock. Finally they will be able to identify the specialist requirements for fighting an LNG fire.

### **Key behaviours**

- Understand the procedures for loading cargo
- Identify the techniques for cargo care and conditioning
- Recognise the stages of preparation for discharging cargo
- Understand the completion of the cargo cycle
- Identify equipment for the protection of personnel
- Understand specialist LNG fire-fighting techniques

### **Topics to be covered**

- Loading cargo
- Loaded voyage
- Discharge cargo
- Prepare for dry dock
- Personnel protection
- Fire-fighting LNG