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## **LIQUEFIED NATURAL GAS (LNG) AS MARINE FUEL**

This three-day course provides a comprehensive overview of LNG and the use of LNG as a marine fuel.



## AUDIENCE

Ship owners and operators, facility operators, vessel crews, port regulators, shipyard personnel and other maritime industry stakeholders interested in gas-fueled ship (GFS) design and operations.

## TRAINING OBJECTIVES

1. Gain perspective about the LNG-fueled fleet's historical development and future trends regarding emission control areas (ECAs), greenhouse gas (GHG) reduction, supply and distribution availability and commercial considerations.
2. Become familiar with LNG properties, hazards, risk management and safe handling practices for LNG GFS ship operation and fuel handling.
3. Raise awareness about LNG GFS design, construction and safety features according to the IGF Code, associated regulations and industry guidelines.
4. Enhance understanding of technical specifications, engineering and operational requirements for LNG marine fuel propulsion systems and fuel gas supply systems.
5. Recognize safe working practices and procedures in accordance with industry guidelines and personal shipboard safety.

## COURSE STRUCTURE

- 1. Welcome**
  - a. Introductions
  - b. Short icebreaker activities
  - c. Introduce learning objectives
- 2. Why Alternative Fuels?**
  - a. Background and drivers (including IMO GHG strategy)
  - b. Alternative fuel types: Advantages and challenges
- 3. LNG as Marine Fuel Introduction**
  - a. LNG characteristics
  - b. LNG properties
  - c. Saturated vapor pressure
- 4. Health and Safety**
  - a. LNG safety measures
  - b. LNG hazards
  - c. Ventilation provisions
  - d. Exposure control
  - e. Emergency procedures
- 5. Rules and Regulations**
  - a. IGF Code (including IACS recommendations)
  - b. STCW Convention
  - c. MARPOL Annex VI
  - d. ABS Marine Vessel Rules, Part 5C
  - e. *ABS Guide for Gas and Other Low-Flashpoint Fuel Ready Vessels* (including notations)
- 6. Design Risk Assessment**
  - a. Reference: *ABS Guidance Notes on Risk Assessment Applications for the Marine and Offshore Industries*
  - b. Risk assessment process
  - c. Risk assessment techniques
  - d. HAZID vs. HAZOP
- 7. LNG-Fueled Engines**
  - a. Overview of technologies
  - b. Engine certification
  - c. Combustion concepts
  - d. Service experience
- 8. Ship Design and Arrangement**
  - a. Arrangement and performance
  - b. Pipe connections
  - c. Tank safety
  - d. Fuel spaces
  - e. Hazardous areas
- 9. Fuel Containment System**
  - a. Functional requirements
  - b. Venting and gas-freeing
  - c. Fuel containment tanks
  - d. Inert gas production and storage
  - e. Boil-off gas control
- 10. Fuel Gas Supply System**
  - a. Characteristics
  - b. Fuel gas supply systems
  - c. Piping and valves
  - d. Remote and automatic operations
- 11. Control, Monitoring, and Safety Systems**
  - a. Functional requirements
  - b. Provisions for:
    - Bunkering station
    - Gas and fire detection
    - Engine monitoring and ventilation
    - Fuel gas supply system
- 12. Fire Safety and Explosion Prevention**
  - a. Fire prevention
  - b. Tank Safety
  - c. Fire protection
  - d. Hazardous areas
- 13. LNG Bunkering Operations**
  - a. Bunkering infrastructure
  - b. Bunkering transfer and arrangement
  - c. Hazards
  - d. Pre-bunkering
  - e. Bunkering process
  - f. Emergency procedures
- 14. ABS Survey Activities**
  - a. Classification requirements
  - b. Surveys during construction:
    - Fuel tanks
    - Piping and valves
    - Bunkering station
    - Fuel gas supply system
    - Fuel consumers
    - Electrical equipment and CMSS
    - Fire safety
    - Sea and dual-fuel LNG trials
  - c. Surveys after construction
- 15. Closing**
  - a. Course recap of each module
  - b. Examination