

Gas Explosion and Other Hazards of LNG Facilities

INTRODUCTION

- This training course covers gas explosion hazards and other hazards encountered on LNG facilities. It addresses all aspects of hazards associated with vapor cloud explosions (VCEs): ignition processes, release and dispersion, explosion mechanisms, blast load and modeling of all these aspects.
- It is essential for fire safety and risk management personnel to understand the principles of fires and explosions in order to determine how fires start and spread, and how explosions occur. Expert knowledge of hazardous area classification is also vital to enabling proper selection and installation of equipment to be used safely in hazardous LNG environments.
- In this 5-day Gas Explosion and Other Hazards of LNG Facilities training course, you will acquire comprehensive knowledge on the causes and properties of explosions, with an emphasis on those involving gases.

Through this training course, you will:

- Understand the properties of flammable and explosive materials as well as their ignition mechanisms
- Discover how mechanical and system failures contribute to major accidents
- Learn about common fire detectors, alarm systems and procedures
- Understand the purpose of classifying hazardous areas, materials and temperature
- Understand equipment protection plans
- Understand LNG release and dispersion
- Understand LNG safety regulations
- Understand Explosion modelling
- Understand Mitigation
- Understand Preventive measures
- Understand Consequence models and QRA methodology
- Understand The oil and gas industry structure
- Understand the LNG project lifecycle

This training course will cover:

- Contemporary issues and industry trends
- Technical aspects of oil and gas creation and development
- Understanding of the gas liquefaction process
- How LNG is stored, loaded and shipped
- Reviewing the structure of LNG receiving terminals
- Appreciation of LNG hazards and safety considerations
- Understanding of the basics and important parameters governing LNG release and dispersion
- Awareness of LNG release and accident statistics and some important LNG accidents
- Understanding of the basics and important parameters governing vapor cloud explosions (VCEs)
- Understanding of the accident chain of events and the important parameters affecting the LNG release and dispersion
- Understanding of various preventive measures to reduce the occurrence of accidents and various mitigation and control techniques to reduce explosion consequences
- Understanding the
 - Properties of LNG
 - Hazards of LNG
 - Physical reaction of LNG
 - Specialist equipment, including PPE
 - Exclusion and hazard distances and behaviors
 - Large scale incidents, including BLEVE
 - Effects and impacts on the response environment
 - Coaching and mentoring during practical / table top based scenario discussions
 - Learning the different gas explosion analysis methods and when they may be applied
 - Understanding of how gas explosion loads can be integrated with the responses of structures

OBJECTIVES

- The aim of this training course is to provide the participants with the knowledge and skills to understand the various hazards of LNG Facilities and how to mitigate pro activate emergency response to incidents.

At the end of the training course, delegates should achieve the following key learning outcomes:

- Understand the basics and important parameters governing vapor cloud explosion (VCEs) and other known hazards
- Be aware of release and accidents statistics and have knowledge of some important offshore accidents that have occurred
- Understand the accident chain of events
- Understand various preventive measures to reduce the occurrence of accidents and various mitigation and control techniques to reduce gas explosion consequences
- Learn the various explosion modeling techniques that may be applied and understand the importance of using advanced 3D modeling for gas analysis
- Learn the different gas explosion analyses methods and when they may be applied
- Understand how gas explosion loads can be integrated with the responses of structures

TRAINING METHODOLOGY

- This Gas Explosion Hazards of LNG Facilities training course will combine presentations with instructor-guided interactive discussions between participants relating to their individual interests. Practical exercises, video material and case studies aiming at stimulating these discussions and providing maximum benefit to the participants will support the formal presentation sessions. Above all, the course leader will make extensive use of case examples and case studies of issues in which he has been personally involved.

ORGANISATIONAL IMPACT

In addition to the professional development of staff, the organization should be able to prioritize resources to demonstrate that process risks are adequately controlled.

- Detailed guidance on good / best practice techniques
- Opportunity to evaluate good / best practice techniques through workshops
- Understand the parameters governing LNG release and dispersion
- Be aware of LNG release and accident statistics
- Understand the parameters governing vapor cloud explosions (VCEs) and other hazards
- Understand the accident chain of events

PERSONAL IMPACT

Attendees will be able to apply skills learnt from this training at a practical level to identify sources of major hazards and to prioritize decisions for their control.

- Understand the parameters governing LNG release and dispersion
- Be aware of LNG release and accident statistics
- Understand the parameters governing vapor cloud explosions (VCEs)
- Understand the accident chain of events
- Understand various preventive measures to reduce the occurrence of accidents and various mitigation and control techniques to reduce explosion consequences
- Learn the various explosion modelling techniques that may be applied and understand the importance of using advance 3D modelling for LNG explosion analyses
- Practical case studies and demonstration on the application of 3D modelling to LNG explosion safety

WHO SHOULD ATTEND?

This training course is suitable for a wide range of professionals involved in managing Hazards and Risk on LNG Facilities including:

- Safety engineers
- Managers and other personnel involved in the design, operation or modification of an offshore oil and gas facility (platforms, FPSO's etc.)
- Accident investigators
- Representatives of governmental or public bodies involved in development of offshore safety regulations
- Anyone who would like to develop an understanding of hazards associated with LNG Facilities

Course Outline

Determination of Course Goals & Introduction to LNG Gas Explosions

- Introduction to the Fundamentals of LNG
- LNG historical accidents – Cleveland explosion, Skikda LNG liquefaction facility explosion, other minor incidents
- Gas explosion basics
- LNG accident consequences models
- Prevention and mitigation
- Cryogenic spill hazards and protection

Hazards

- Gas explosion Hazards
- Explosion risk analyses
- Basic hazard identification methods – HAZID, release scenarios, potential for explosions
- Dispersion models – passive/lighter than air, momentum jet, heavy gas and CFD techniques
- Understanding FMEA and other tools for assessing Hazards
- LNG Hazard and Risk Assessment
- Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water
- Group Table Top exercise

Assessment and Analysis

- LNG safety regulations – NFPA 59A, EN 1473
- Hazard assessment methodologies – deterministic v probabilistic methods
- Deterministic analyses – onshore liquefaction (export and truck-loading facilities)
- Probabilistic analyses – onshore liquefaction
- Probabilistic analyses – floating LNG (safety gaps, grated decks, layout examples)

Mitigation

- Explosion accidents: statistics and examples
- (Class Activity) Explosion investigation of rough 47/3B platform
- Release and dispersion in offshore facilities
- Ignition sources
- Preventative measures
- Mitigation and control
- Fires, including:
 - How do fires occur?
 - Characteristics of jet and pool fires
 - How fires cause damage and how the potential for damage can be assessed
 - Mitigation
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- Dispersion, including:
 - Characteristics of vapor dispersion following a liquid spill
 - Potential effects of delayed ignition
 - Gas accumulation within confined structures
 - Dispersion of releases in onshore and offshore facilities and from Pipelines
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- Explosions, including:
 - Mechanism for pressure generation in congested process regions
 - Effect of confinement and congestion on explosions
 - Deflagration to detonation transition
 - Methods for estimating explosion loading and mitigation

Explosion Modelling

- Explosion modelling – VCE, confined, semi-confined, vessel burst and dust explosions
- Fire modelling – pool, jet, fireballs and assumptions
- Application of results – inputs to risk analysis, QRA, LOPA etc. along with emergency response plans, escape and evacuation
- Explosion Risk Management:
 - Objective and motivation
 - Simple approach