



THE CHEMICAL ENGINEERING MAJOR

Gas Explosion and Other Hazards of LNG Facilities

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COURSE OVERVIEW

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.

This training course covers gas explosion hazards and other hazards encountered in 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. In this Gas Explosion and Other Hazards of LNG Facilities training course, you will acquire comprehensive knowledge of the causes and properties of explosions, emphasizing those involving gases.

LEARNING 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 an 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

TARGET AUDIENCE

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 the development of offshore safety regulations
- Anyone who would like to develop an understanding of hazards associated with LNG Facilities

COURSE CONTENTS

Module 1: Determination of Course Goals & Introduction to LNG Gas Explosions

- **KeyTopics:**

- 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

Module 2: Hazards

- **KeyTopics:**

- 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

Module 3: Assessment and Analysis

• KeyTopics:

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

Module 4: Mitigation

• KeyTopics:

- 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
 - Dispersion
 - Explosions

Module 5: Explosion Modelling

• KeyTopics:

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