

## ASSESSMENT OF PROCESS HAZARDS, RISK AND APPROPRIATE PROTECTION SYSTEMS

### Course Objective

The purpose of this course is to:

- Discuss the range of general process hazards that may result in loss of containment or loss of production with the consequent potential for on-site and off-site injury
- Present a general review of the hazard identification techniques that have been developed in the petrochemical industry for identifying and assessing risk, either qualitatively or quantitatively.
- Present the concept of risk and methodologies by which the level of risk associated with a system can be assessed in an objective manner
- Present an outline of inherently safer concepts
- Explain the LOPA (Layer of Protection Analysis) methodology with its assumptions, advantages and disadvantages
- Present an outline of the fully quantitative methodologies (Fault Tree and Quantitative Risk Assessment) that may be required for some complex studies
- Discuss the various types of protection that can be employed including the basic process control system, relief devices and safety interlock systems (SIS)
- Present detailed discussion of relief valve issues
- Present detailed discussion of SIS systems including their specification, analysis, installation and testing.

### Who Should Attend?

- New graduates who wish to gain an understanding of practical process design issues
- Individuals who are managing and performing process design and process hazard evaluations or risk assessments for operating facilities, or are coordinating project activities
- Individuals who require an understanding of relief system design

### Course Description

1. *General Process Hazards*
  - a. Flammability - Fire/Explosion/Ignition and Prevention
  - b. Materials of Construction and Corrosion
  - c. Health Hazards Awareness
  - d. Reactive Chemical Hazards
  - e. Process Equipment (Loading/Unloading, Storage, Unit Operations)
  - f. Electrical System Hazards
  - g. Piping Systems
  - h. Heat Transfer Fluid System Issues
  - i. Thermal Insulation Issues
  - j. Human Error
2. *Process Hazard Identification Techniques*
  - a. Risk Identification and Assessment (Process Hazard Assessment (PHA) and Risk)



- b. Introduction to:
  - i. What-If
  - ii. Checklist
  - iii. What-If/Checklist
  - iv. FEMA
  - v. HAZOP
  - vi. LOPA
  - vii. Fault Tree
  - viii. QRA
  
- 3. *Risk*
  - a. Risk
  - b. What is risk
  - c. How can risk be assessed?
  - d. Objective Consequence and Risk Tolerance Criteria
  - e. Corporate Process Safety Management Systems
  
- 4. *Plant Design, Inherently Safer Concepts, Management Systems and Post-Event Mitigation*
  - a. Plant Design
    - i. Process
    - ii. Site
    - iii. Layout
    - iv. Civil
    - v. Structural/Architectural
    - vi. Utilities
  
  - b. Inherently 'Safer' Design Philosophy
  - c. Documentation
  - d. Management of Change
  - e. Fire Protection
  
- 5. *LOPA (Layer of Protection Analysis)*
  - a. Terms Used in LOPA
  - b. Where LOPA Fits in family of Risk Assessment Techniques
  - c. Strengths and Weaknesses of LOPA
  - d. Methodology
    - i. Consequences and Severity
    - ii. Scenario Development
    - iii. Initiating Events
    - iv. Independent Protection Layers (versus Safeguards)
    - v. Calculations



- e. Making Risk Decisions
  - f. Advanced LOPA Topics
  - g. Using LOPA for Other Applications
  - h. Implementing LOPA in an Organization
    - i. Objective Risk Tolerance Criteria
    - ii. Culture
    - iii. Commitment
  - i. Worked Examples
6. *Types of Protection (Basic Process Control System, Relief Valves, SIS)*
- a. Introduction to Process Monitoring and Control (BPCS)
  - b. Instrumentation
  - c. Testing
  - d. Alarm action
  - e. Alarm management
  - f. Mechanical interlocks
  - g. Procedural interlocks
  - h. Independent interlocks
  - i. Introduction to Safety Interlock Systems
  - j. Introduction to Relief and Discharge Systems
7. *Relief Valves*
- a. Function of Relief Systems
  - b. Equipment Design Issues
  - c. Codes, Laws, Standards and Practices, Design Pressure and Temperature, Maximum Allowable Working Pressure, Basic Pressure Relief System Requirements, Etc.
  - d. Determination of Relief Loads
  - e. Evaluating Reactive Chemical Hazards
  - f. Storage Tanks
  - g. Pressure Relief Device Selection
  - h. Pressure Relief Device Sizing
    - i. Single Phase
    - ii. Two Phase
  - i. Device Specification and Installation
  - j. Flare Headers
  - k. Pressure Loss Calculations
  - l. Discharge Systems
  - m. Documentation
  - n. Inspection and Maintenance



8. *Safety Interlock Systems*

- a. Purpose of SIS Systems
- b. Nomenclature
  - i. SIS
  - ii. SIF
  - iii. SIL
- c. Basic concepts
- d. Security
- e. Redundancy
- f. Test frequency
- g. Base data
- h. Vendor options
- i. Design options
- j. Maintenance
- k. Human error

9. *Examples and Problems*

**Course Duration**

3 – 4 Days