

Who Should Attend?

This course provides an overview of process safety engineering fundamentals for hydrocarbon processing facilities, with emphasis on the upstream oil & gas sector. The focus of this course is on the engineering/design aspects of Process Safety Management. Frequent reference will be made to historical incidents and recurring problem areas. Techniques for analyzing and mitigating process safety hazards applicable to oil and gas processing will be reviewed. Integration of the concepts covered to achieve a measured approach to Process Safety Engineering is a key aim of this course. Exercises and group projects will be utilized throughout the course to emphasize the key learning points.

Designed for facilities, process and design engineers, supervisory/management personnel, as well as new safety/loss prevention engineers and HSE professionals who require an overview of Process Safety Engineering.

The Participant Will Learn How To:

- Types of equipment and process systems that have historically been problematic in the upstream oil & gas industry
- Basics of risk analysis
- Thinking in terms of Inherently Safer Design
- Commonly used process hazards analysis methods and where they are used
- "Layers of Protection" concept - what the different layers are and how they are applied
- Detection and mitigation methods for different types of hazards

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Process Safety Engineering (PS-4)

Course Outline

Daily schedule is approximate.

DAY	TOPICS
DAY 1	<ul style="list-style-type: none"> • Overview and Course Objectives • Risk analysis methods <ul style="list-style-type: none"> - Definition of risk - Tolerable risk criteria - ALARP - Risk analysis method • Inherently Safer Design <ul style="list-style-type: none"> - Definition of Inherently Safer Design (ISD) - ISD strategies - Application of ISD to upstream oil & gas facilities • Process Hazards Analysis Techniques – Overview <ul style="list-style-type: none"> - Purpose of PHA's - PHA techniques and their applications - PHA revalidation requirements • Layer of Protection Analysis <ul style="list-style-type: none"> - What is LOPA? - The layers of protection concept - Independent protection layers - LOPA methodology
DAY 2	<ul style="list-style-type: none"> • Historical Incident Databases <ul style="list-style-type: none"> - What is a Historical Incident Database (HID)? - How are HID's useful? - Incident frequencies - Onshore & offshore data • Leakage and Dispersion of Hydrocarbon Releases <ul style="list-style-type: none"> - Behavior of different materials upon release - Quantification of gas & liquid release rates - Estimation of vapor cloud size - Dispersion calculations, eg. toxic (H₂S) or hydrocarbon gas - Probit functions
DAY 3	<ul style="list-style-type: none"> • Combustion Behavior of Hydrocarbons <ul style="list-style-type: none"> - The fire triangle - Combustion properties - Characteristics of different types of fires - Thermal radiation calculations & effects - Vapor cloud explosions • Sources of Ignition <ul style="list-style-type: none"> - Ignition characteristics of different fuels - Most common causes of ignition – onshore & offshore - Ignition source control options
DAY 4	<ul style="list-style-type: none"> • Hazards Associated with Specific Plant Systems & Equipment <ul style="list-style-type: none"> - More detailed look at equipment types most often involved in leak/fire/explosion incidents - Piping systems - Storage facilities - Pumps - Fire Heaters, etc. • Plant Layout & Equipment Spacing <ul style="list-style-type: none"> - General criteria - Typical site layout methodology - Hazard assessment in plant layout - Spacing guidelines • Pressure Relief and Flare Systems <ul style="list-style-type: none"> - Causes of overpressure - Overpressure protection options - Pressure relief valves – types & applications - Relief valve sizing - Flare systems - Thermal radiation from flares & effects - Flare gas recovery systems • Corrosion & Materials Selection <ul style="list-style-type: none"> - One of the main causes of failure/hydrocarbon release - Why metals corrode - The basic corrosion cell - Most common corrosion mechanisms in upstream oil & gas facilities - Corrosion control methods - Erosion/sand detection • Process Monitoring & Control
DAY 5	<ul style="list-style-type: none"> • Process Monitoring and Control <ul style="list-style-type: none"> - One of the first layers of protection - Most commonly controlled process variables - Basic control methods - Understanding the main objectives of process control - Alarm & shutdown settings • Safety Instrumented Systems <ul style="list-style-type: none"> - Definitions - SIS components - SIS examples – including High Integrity Pressure Protection Systems - SIL assessment methods • Fire & Explosion Protection Principles <ul style="list-style-type: none"> - Basic fire protection strategies - Fireproofing - Fire & blast walls - Fire & gas detection systems - Firewater systems - Foam systems • Course Review and Summary