CONCEPT

Process Safety Management (PSM): Risk Based Process Safety, HAZOP, LOPA and Barrier Control



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Technical depth: Practitioner · **Practical mode:** Case study

Introduction

Fires, explosions and toxic releases in process facilities rarely come from a single failure. They follow the gradual erosion of barriers: an unreviewed change, an overdue inspection, a bypassed trip, a procedure no one follows. Personal injury rates say little about this exposure. This Core Concept course equips engineers and safety professionals to run process safety management as a working system, using the CCPS Risk Based Process Safety framework, HAZOP, LOPA and recognised performance indicators. Working on cases from refining, chemicals and utilities, participants produce a PSM Gap Assessment and Improvement Plan for their own facility.

Course Objectives

- Distinguish process safety from occupational safety and assess a facility's process safety management against the RBPS elements
- Apply HAZOP, LOPA and bowtie methods to identify major accident hazards and judge the adequacy of protection layers
- Maintain process safety information, operating limits, management of change and pre-startup safety review to a defined standard
- Plan mechanical integrity and barrier management for safety-critical equipment and instrumented systems
- Measure process safety performance with tiered leading and lagging indicators
- Produce a PSM Gap Assessment and Improvement Plan for the participant's own facility

Target Audience

- Process and chemical engineers responsible for hazard studies and process safety information
- Operations and production staff accountable for safe operating limits and change control
- HSE and process safety professionals who own the facility's PSM system
- Safety advisors who review hazard studies, work permits and safeguards and advise operating teams on process risk
- Compliance team members who check that the facility's PSM system meets company standards and the applicable regulations
- Maintenance, reliability and inspection engineers responsible for safety-critical equipment
- Technical safety and instrumentation engineers managing protective and instrumented systems
- Project engineers handing new or modified units over to operations

Course Outline

Day 1: Process Safety Foundations and Current-State Assessment

- Process Safety Versus Occupational Safety: Loss of Primary Containment Concepts
- Major Accident Case Lessons: Toxic Release, Refinery Explosion and Tank Overfill Events
- CCPS Risk Based Process Safety: Four Pillars and 20 Elements
- Process Safety Culture Survey and Maturity Assessment
- PSM Current-State Gap Assessment Against RBPS Elements

Day 2: Hazard Analysis Methods and Protection Layer Standards

- Process Hazard Analysis Method Selection: Checklist, What-If and FMEA
- HAZOP Study Procedure, Nodes and Guide Words Under IEC 61882
- Layer of Protection Analysis LOPA and Independent Protection Layer Criteria
- Safety Instrumented Functions and SIL Determination Under IEC 61511
- Bowtie Barrier Analysis for Major Accident Hazards

Day 3: Managing Process Risk Day to Day

- Process Safety Information Pack: P&IDs, Heat and Material Balances and Safety Data Sheets
- Operating Procedures and Safe Operating Limits Tables
- Management of Change Workflow for Technical, Organisational and Temporary Changes
- Mechanical Integrity and Inspection Planning for Safety-Critical Equipment
- Pre-Startup Safety Review PSSR Checklist

Day 4: Barrier Failure, Performance Indicators and Regulation

- Process Safety Event Tiers 1 to 4 Under API RP 754
- Upstream Process Safety KPIs Under IOGP Report 456
- Bypass, Override and Barrier Degradation Management
- Contractor and Safe Work Practice Interfaces in Operating Units
- Prescriptive and Goal-Setting Safety Case Regulatory Models Compared

Day 5: Case Work and the PSM Gap Assessment

- Refining Case Study: HAZOP and LOPA of a Distillation Column Node
- Chemical Plant Case Study: Management of Change Failure Analysis
- Process Safety Indicator Dashboard Build
- PSM Gap Assessment and Improvement Plan Drafting
- Peer Challenge Panel and Plan Defence

Skills You Will Gain

- Process Hazard Analysis
- Protection Layer Assessment
- Barrier Management
- Management of Change Control
- Mechanical Integrity Planning
- Process Safety Performance Measurement
- PSM System Assessment

Why Attend This Course

- Return to work with a PSM Gap Assessment and Improvement Plan for your own facility, already tested against peer challenge
- Read a HAZOP or LOPA report critically and know when a safeguard is being credited that should not be
- See where your facility's barriers are degrading before an event exposes it
- Compare process safety practice with engineers and safety professionals from other sectors and countries

Conclusion

Major accidents are prevented by barriers that are identified, maintained and monitored, not by good intentions. This course moves from the RBPS framework and a current-state assessment, through HAZOP, LOPA, bowtie and instrumented protection, to the daily disciplines of process safety information, change control, integrity and pre-startup review. The final day turns that material into a PSM Gap Assessment and Improvement Plan, giving participants a prioritised route to stronger process safety performance at their own facility.