

Course No. 1345

Process Safety: HAZOP, LOPA & SIL Training Course

PROCESS ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Process Safety: HAZOP, LOPA & SIL Training Course provides a comprehensive framework for identifying, assessing, and controlling process safety risks in complex operational environments. The course equips participants with practical knowledge of Hazard and Operability Studies (HAZOP), Layers of Protection Analysis (LOPA), and Safety Integrity Level (SIL) concepts, enabling organizations to make disciplined, risk-informed decisions across the lifecycle of process facilities and critical operations.

For government entities, ministries, public sector organizations, oil and gas companies, utilities, chemical and manufacturing facilities, infrastructure operators, and large corporations, process safety is essential to protecting people, assets, the environment, operations, and organizational continuity. Effective process safety management requires more than compliance with procedures; it requires a structured understanding of process hazards, credible scenarios, safeguards, human factors, technical controls, and the effectiveness of protective systems.

This Process Safety: HAZOP, LOPA & SIL Training Course examines how HAZOP, LOPA, and SIL methods work together. HAZOP supports the systematic identification of deviations, causes, consequences, and safeguards. LOPA helps organizations evaluate risk scenarios and determine whether existing independent protection layers provide adequate risk reduction. SIL concepts support the specification and management of safety instrumented functions where additional risk reduction is required.

The course emphasizes the practical connection between process design, operating procedures, maintenance, inspection, alarm management, emergency response, management of change, and asset integrity. Participants will learn how to contribute effectively to multidisciplinary studies, challenge assumptions constructively, document decisions, define action plans, and verify that risk-control measures remain effective throughout operation.

Through structured workshops and case-based exercises, participants will develop the ability to apply HAZOP, LOPA, and SIL principles within their own organizational context. The course supports executives and managers in strengthening governance and risk oversight while enabling engineers, specialists, supervisors, and operational teams to improve hazard identification, safeguard management, and process safety performance.

Objectives

- Analyze the role of process safety management in protecting people, assets, operations, the environment, and organizational continuity during the course.
- Assess process hazards, operational deviations, and credible incident scenarios using a structured HAZOP study approach.
- Develop clear node definitions, design intent statements, guideword applications, and deviation records for selected process systems.
- Evaluate causes, consequences, existing safeguards, and action requirements for identified HAZOP deviations.
- Apply LOPA principles to determine the adequacy of independent protection layers for selected high-consequence scenarios.
- Design practical risk scenarios that define initiating events, consequences, conditional modifiers, protection layers, and risk-reduction needs.
- Evaluate the independence, effectiveness, auditability, and reliability of existing safeguards and protection layers.
- Assess when safety instrumented functions may be required and explain the purpose of Safety Integrity Level allocation.
- Strengthen the integration of HAZOP, LOPA, SIL, alarm management, operating procedures, maintenance, emergency response, and management of change.
- Implement action-tracking and governance practices that support timely closure of HAZOP and LOPA recommendations.
- Improve multidisciplinary team participation, facilitation, documentation, and decision-making during process safety reviews.
- Develop a time-bound action plan to strengthen HAZOP, LOPA, and SIL practices within the participant's organization.

Who Should Attend

The Process Safety: HAZOP, LOPA & SIL Training Course is designed for process safety managers, HSE managers, engineering managers, operations managers, maintenance managers, reliability managers, asset integrity managers, project managers, plant managers, and technical services leaders. It is particularly valuable for executives, directors, and decision makers responsible for process safety governance, operational risk, capital projects, compliance, emergency preparedness, business continuity, and the safe operation of critical facilities.

The course is suitable for process engineers, chemical engineers, mechanical engineers, electrical engineers, instrumentation and control engineers, automation specialists, operations engineers, maintenance engineers, reliability engineers, design engineers, project engineers, inspection engineers, safety engineers, and technical supervisors. It is relevant to professionals involved in process design, modification, commissioning, operation, maintenance, inspection, control systems, safety systems, and shutdown planning.

Professionals in quality, risk management, internal audit, compliance, procurement, contractor management, emergency response, business continuity, digital transformation, and operational excellence may also benefit where their responsibilities intersect with high-risk operations, process changes, safety-critical equipment, operational procedures, or assurance activities. The course supports multidisciplinary teams that need a common language and structured process for assessing hazards and managing the effectiveness of protective barriers.

Learning Outcomes

- Explain the relationship between process safety, operational risk, asset integrity, reliability, emergency preparedness, and business continuity.
- Describe the purpose, scope, inputs, outputs, and practical limitations of HAZOP, LOPA, and SIL studies.
- Define process nodes and design intent statements that support effective hazard and operability analysis.
- Apply guidewords and process parameters to identify deviations, causes, consequences, safeguards, and recommendations.
- Distinguish between process hazards, operational issues, occupational safety hazards, and process safety scenarios.
- Develop credible LOPA scenarios using initiating events, consequences, conditional modifiers, and independent protection layers.
- Assess whether safeguards meet the requirements of independence, effectiveness, dependability, and auditability.
- Identify circumstances in which additional risk reduction or a safety instrumented function should be considered.
- Explain the role of Safety Integrity Levels in specifying performance requirements for safety instrumented functions.

- Contribute effectively to HAZOP and LOPA workshops through evidence-based discussion, clear documentation, and disciplined follow-up.
- Link study recommendations to design changes, operating procedures, maintenance routines, alarms, inspections, training, and emergency controls.
- Prepare an initial process safety improvement plan that includes priorities, owners, milestones, and assurance measures.

Course Outline

DAY 01

Process Safety Foundations and Risk Management

- Process safety principles, major hazard awareness, barrier management, and the relationship between process safety and occupational safety.
- The role of HAZOP, LOPA, SIL, risk assessment, asset integrity, reliability, and emergency preparedness in process safety management.
- Process safety lifecycle considerations: design, construction, commissioning, operation, maintenance, modification, shutdown, and decommissioning.
- Process safety governance, leadership responsibilities, competency, documentation, multidisciplinary teamwork, and assurance.

PRACTICAL APPLICATION OR DISCUSSION

Reviewing process safety scenarios and identifying critical hazards, barriers, and decision-making priorities.

DAY 02

HAZOP Methodology and Hazard Identification

- HAZOP purpose, study preparation, required information, team composition, roles, facilitation, and recording practices.
- Defining study boundaries, process nodes, design intent, process parameters, guidewords, and deviations.
- Identifying causes, consequences, existing safeguards, actions, assumptions, and recommendations.

DAY 02 — CONTINUED

- Managing human factors, procedural deviations, utility failures, equipment malfunction, control-system failures, and abnormal operating conditions.

PRACTICAL APPLICATION OR DISCUSSION

Conducting a guided HAZOP review for a selected process node and documenting key findings.

DAY 03

LOPA and Independent Protection Layers

- LOPA purpose, scope, relationship to HAZOP, scenario selection, and risk-based prioritization.
- Defining initiating events, consequence severity, enabling conditions, conditional modifiers, and target risk criteria.
- Independent protection layers: process design, basic process control systems, alarms and operator response, relief systems, safety instrumented systems, and emergency response.
- Assessing protection-layer independence, effectiveness, reliability, documentation, testing, maintenance, and auditability.

PRACTICAL APPLICATION OR DISCUSSION

Developing a LOPA worksheet for a selected high-consequence HAZOP scenario.

DAY 04

SIL Concepts and Safety Instrumented Functions

- Safety instrumented systems, safety instrumented functions, sensors, logic solvers, final elements, and lifecycle responsibilities.
- SIL concepts, risk reduction requirements, SIL allocation, and the role of LOPA in identifying performance targets.
- Functional safety requirements, cause-and-effect documentation, design assumptions, proof testing, bypass management, and maintenance considerations.
- Integration of safety systems with alarm management, control systems, operating procedures, training, emergency response, and management of change.

DAY 04 — CONTINUED

PRACTICAL APPLICATION OR DISCUSSION

Reviewing a safety instrumented function concept and identifying requirements for performance, testing, documentation, and ownership.

DAY 05

Governance, Action Management, and Sustainable Process Safety Improvement

- HAZOP, LOPA, and SIL action management: ownership, prioritization, due dates, closure evidence, verification, and escalation.
- Integrating process safety studies with project reviews, pre-startup safety reviews, operating procedures, maintenance strategies, inspection plans, and change management.
- Performance assurance through audits, barrier-health reviews, testing compliance, incident learning, management review, and continuous improvement.
- Building process safety capability through leadership engagement, competency development, contractor coordination, communication, and learning from operational experience.

FINAL WORKSHOP, ACTION PLAN, OR IMPLEMENTATION EXERCISE

Developing a 90-day HAZOP, LOPA, and SIL improvement plan with priority actions, accountable owners, milestones, assurance activities, and performance measures.

Register or Request More Information

Course page: <https://quest-training.com/courses/process-safety-hazop-lopa-sil-training-course>

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