



Advanced Layers of Protection Analysis (LOPA) Training Course

17 – 21 May 2027
Singapore

Advanced Layers of Protection Analysis (LOPA) Training Course

Ref: 1358_200405 **Date:** 17 – 21 May 2027 **Location:** Singapore **Fees:** 5700 Euro

Overview

Advanced Layers of Protection Analysis LOPA Training Course is a one-week course for process safety, HSE, risk, operations, maintenance, and technical personnel who leave with a documented LOPA Study Pack. Participants develop a LOPA scenario, assign initiating event frequency, validate independent protection layers, apply probability of failure on demand, account for enabling conditions and conditional modifiers, compare mitigated risk with criteria, and document risk reduction decisions. Agile Leaders Training Center presents LOPA risk assessment through calculation-led case practice.

Who Should Attend

- Functions responsible for process hazard analysis and risk studies
- Teams responsible for operating and maintaining process safeguards
- Personnel responsible for functional safety and instrumented protection
- Functions responsible for HSE assurance and risk acceptance decisions
- Technical leaders responsible for study quality and recommendation closure

The course assumes participants can interpret process hazards and basic risk matrices and leaves out introductory hazard identification, detailed consequence modeling, and safety-system engineering design.

Departments and Industries

The course supports departments and industries that manage major process hazards and safeguard performance.

- Oil, gas, petrochemical, chemical, and energy operations
- Pharmaceutical, food, pulp, paper, and process manufacturing
- Process safety, HSE, engineering, and technical assurance functions
- Operations, maintenance, reliability, and asset integrity teams
- Project design, functional safety, and risk review groups

Learning Objectives

By the end of this course, participants will be able to:



- Build a single cause-consequence LOPA scenario
- Analyze initiating events and assign defensible frequencies
- Evaluate safeguards against independent protection layer criteria
- Apply PFD, enabling-condition, and conditional-modifier calculations
- Compare mitigated consequence frequency with risk criteria
- Build a documented LOPA Study Pack and action register

Course Agenda

Day 1: LOPA Scope and Scenario Definition

- LOPA Position in the Process Hazard Analysis Workflow
- Single Cause-Consequence Scenario Definition Template
- Consequence Screening and Severity Classification Guide
- Scenario Boundary and Assumption Register
- LOPA Team Roles and Facilitation RACI

Day 2: Initiating Events and Frequency

- Initiating Event Identification Decision Tree
- Initiating Event Frequency Data Selection Sheet
- Human Error Frequency Assessment Method
- Enabling Condition Application Checklist
- Conditional Modifier Treatment Worksheet

Day 3: Independent Protection Layers

- Independent Protection Layer Qualification Test
- IPL Independence and Auditability Evidence Record
- Probability of Failure on Demand Selection Table
- Basic Process Control and Alarm Credit Review
- Safety Instrumented Function and IEC 61511 Context Map

Day 4: Risk Calculation and Decisions

- Mitigated Consequence Frequency Calculation Sheet
- Risk Tolerance Criteria Comparison Matrix
- Risk Reduction Gap Assessment Tool
- Additional Safeguard Option Evaluation Grid
- LOPA Recommendation and Action Tracking Register

Day 5: LOPA Study Practice

- Exercise: Define a Cause-Consequence Scenario
- Exercise: Assign Initiating Event and Modifier Values
- Exercise: Validate IPLs and Apply PFD Values
- Exercise: Calculate Risk Gap and Select Actions
- Capstone Exercise: Documented LOPA Study Pack

Practical Exercises

The course uses suggested activities from energy, chemical, pharmaceutical, and process manufacturing settings.

- Suggested activity: convert a hazard-study scenario into a bounded cause-consequence LOPA worksheet.
- Suggested activity: test proposed safeguards for independence, functionality, integrity, reliability, and auditability.
- Suggested activity: calculate mitigated consequence frequency using event, modifier, and PFD values.
- Suggested activity: build a LOPA Study Pack with assumptions, evidence, calculations, decisions, recommendations, and owners.

FAQs

What is Layers of Protection Analysis LOPA?

Layers of Protection Analysis LOPA is a semi-quantitative method that evaluates one cause-consequence scenario at a time using initiating event frequency, protection-layer failure probabilities, modifiers, and risk criteria.

Who suits Layers of Protection Analysis training, and what does it assume?

Layers of Protection Analysis training suits personnel who conduct or review process-risk studies and assumes familiarity with process hazards, safeguards, and basic likelihood-consequence risk assessment.

How does LOPA training differ from HAZOP training?

LOPA training quantifies one selected cause-consequence scenario and tests risk reduction from independent layers, while HAZOP training systematically identifies deviations, causes, consequences, and safeguards across a process design.



What qualifies as an independent protection layer in LOPA?

An independent protection layer must act independently of the initiating event and other credited layers, perform a defined protective function, have justified integrity and reliability, and remain auditable through its life cycle.

How is probability of failure on demand used in LOPA?

Probability of failure on demand represents the chance that a credited protection layer will fail when required and is combined with initiating event frequency and applicable modifiers to estimate mitigated consequence frequency.

Conclusion

The course connects scenario definition, initiating events, modifiers, IPL validation, PFD calculation, risk criteria, and recommendation management. Participants take back a documented LOPA Study Pack containing assumptions, evidence, calculations, decisions, actions, and owners. The pack changes how study teams justify safeguard credit, identify risk gaps, and record risk reduction decisions.