
Layer of Protection Analysis Training Course: Scenarios, Protection Layers and Residual Risk

13 – 17 September 2027
Milan





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Ref: 706_34487 **Date:** 13 – 17 September 2027 **Location:** Milan **Fees:** 5500 GBP

Programme Summary

Layer of protection analysis is the subject of this one-week advanced training course for process safety engineers, operations managers and HSE leads in process plants, ending in a LOPA scenario file for one process unit. Hazard studies list many scenarios, yet teams often lack a consistent way to judge whether safeguards bring risk to a tolerable level. The programme moves from scenario selection to initiating events, protection layers and decisions on residual risk, using cases from refining, chemicals and gas processing. Mars Training Centre UK delivers this programme on layer of protection analysis to mixed-organisation cohorts.

The Business Case

A plant that relies on unexamined safeguards may carry scenarios that look controlled on paper but depend on layers that are not independent, not tested or not credited correctly. Without that discipline, protection spending drifts towards the loudest concern rather than the largest remaining risk. A shared method lets technical and operations leaders compare scenarios on one scale and justify each decision to peers and auditors.

- **Residual Risk Visibility:** Improves as every high-consequence scenario carries a recorded frequency and protection credit.
- **Safeguard Spending:** Is directed to the scenarios where added protection changes risk most.
- **Decision Defensibility:** Improves as assumptions and layer credits are written down and challenged.

Principles and Evidence Base

- IEC 61511: Sets functional safety requirements for safety instrumented systems in the process industry, and guides the treatment of safety instrumented functions in Sessions 4 and 5.
- IEC 61508: Provides the general functional safety basis behind risk reduction targets, applied in Session 4.
- ISO 31000 risk management process: Structures identification, analysis, evaluation and treatment of risk, applied in Sessions 1, 2 and 3.

Intended Participants

- Process safety engineers who lead scenario analysis after hazard studies.
- Operations and technical managers who own the safeguards that plants rely on.
- Risk leads who set and apply tolerable risk criteria across units.
- Instrument engineers who define and verify safety functions.
- HSE leaders who present risk decisions to management and auditors.



Typical settings include refineries, chemical plants and gas processing facilities.

Learning Outcomes

1. Participants will be able to prioritise hazard study scenarios for analysis by consequence.
2. Participants will be able to evaluate initiating event frequencies against plant failure and demand evidence.
3. Participants will be able to diagnose whether a safeguard qualifies as an independent protection layer.
4. Participants will be able to calculate the residual risk of a scenario and the risk reduction still required.
5. Participants will be able to design a safety instrumented function target or an alternative layer to close a gap.
6. Participants will be able to justify a LOPA scenario file for one process unit to management or an auditor.

Programme Structure

Day 1: Layer of Protection Analysis Foundations and Scenario Selection

Which scenarios deserve analysis, and how is each one defined?

- ISO 31000 Process Applied to Process Risk
- Hazard Study Scenario Register
- Consequence Severity Screening
- Tolerable Risk Criteria Sheet
- Scenario Definition Template

Day 2: Initiating Events and Frequency Evidence

How often can the scenario start, and what evidence supports that figure?

- Initiating Event Catalogue
- Plant Failure Data Review
- Demand Rate Estimation
- Human Error Contribution Check
- Frequency Assumption Log

Day 3: Independent Protection Layers

Which safeguards truly count, and how much risk does each remove?



- Independence and Effectiveness Test
- Alarm and Operator Response Credit
- Relief and Mechanical Layer Credit
- Enabling Conditions and Modifiers
- Protection Layer Credit Table

Day 4: Risk Reduction Targets and Safety Functions

How much further reduction is needed, and by what means?

- Residual Risk Calculation
- Risk Reduction Gap Statement
- IEC 61511 Safety Function Targets
- IEC 61508 Reduction Basis Review
- Layer Addition Option Review

Day 5: LOPA Scenario File for One Process Unit

Do the earlier records support one defensible set of decisions?

- Applying the Session 1 Scenario Register
- Testing the Session 2 Frequency Assumption Log
- Reviewing the Session 3 Protection Layer Credit Table
- Checking the Session 4 Risk Reduction Gap Statement
- Completing the LOPA Scenario File

Methodology

The programme uses case analysis built on a shared process unit with hazard study records and alarm and shutdown data. Participants analyse prepared scenarios, test each safeguard for independence, calculate residual risk and then adapt the same worksheets to scenarios from their own plant.

- Suggested activity: Testing whether an operator response to an alarm can be credited as a protection layer.
- Suggested activity: Comparing two proposals to close a risk gap, one instrumented and one mechanical.
- Suggested activity: Reviewing a scenario worksheet for hidden common causes.

Capstone Output

Each participant completes a LOPA scenario file for one process unit. It holds a prioritised scenario list, initiating event frequencies with evidence, a protection layer credit table, residual risk results and a decision record for each gap. The file is used at work to brief management, plan safeguard projects and answer audit questions.



Frequently Asked Questions

Is layer of protection analysis training suitable for engineers who have only joined hazard studies?

Yes. Layer of protection analysis is taught through worked scenarios and templates. It assumes participation in hazard studies and familiarity with plant safeguards.

Which standards does layer of protection analysis training rest on?

Layer of protection analysis training rests on IEC 61511 and IEC 61508 for safety functions and risk reduction, together with the ISO 31000 risk management process.

How is the scenario file from layer of protection analysis training used at work?

You use the LOPA scenario file to brief management, rank safeguard projects, and answer auditors on residual risk decisions.

How does layer of protection analysis differ from hazard study training?

Layer of protection analysis tests selected scenarios for frequency, protection layers and residual risk, while hazard study training focuses on identifying scenarios and deviations in the first place.