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COURSE BROCHURE

# Advanced Risk and Reliability Assessment for Asset Integrity Training Course

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Registered in the United Kingdom and Saudi Arabia

# Advanced Risk and Reliability Assessment for Asset Integrity Training Course

Risk and Reliability Assessment for Asset Integrity is a 2-week advanced training course for reliability, safety and risk engineers and asset integrity managers who must quantify how process equipment fails and what those failures cost, ending with a Process Unit Risk and Reliability Assessment. Ageing plant, longer run lengths and tighter integrity budgets now demand numbers, not opinions, behind every inspection and redundancy decision. Jupiter Prime Training offers this course for integrity specialists.

## Why Risk and Reliability Assessment for Asset Integrity Matters Now

Three groups shape integrity decisions today: operators who stretch intervals between shutdowns and need evidence that equipment will last, insurers and corporate risk committees that ask for quantified failure scenarios, and finance teams that question every inspection campaign and spare train. Organisations that model failure frequencies and consequences well spend inspection effort where risk sits and justify redundancy with confidence; those that rely on habit over-inspect benign equipment and miss degrading items. The course draws on IEC 60812 for failure modes and effects analysis and IEC 61882 for hazard and operability studies, linking both to quantitative reliability modelling.

## Who Gains Most from Risk and Reliability Assessment for Asset Integrity

- Engineers who build failure models, fault trees and availability estimates for process systems
- Specialists who rank equipment by risk to set inspection scope and intervals
- Engineers who verify that safety instrumented functions meet their target integrity
- Managers who own the asset integrity budget and its risk register
- Analysts who translate hazard study findings into frequency and consequence estimates

An asset integrity department gains most when its reliability engineer, an inspection lead and a process safety engineer attend together and agree one risk matrix and data set.

## Risk and Reliability Assessment for Asset Integrity Capabilities

Participants move from qualitative checklists to models that put failure probability, consequence and availability side by side for each item of equipment.

- Build FMECA worksheets with criticality ranking for pumps, compressors and vessels — maintenance strategy selection
- Calculate top-event frequencies with fault tree analysis and outcome frequencies with event trees — risk acceptance decisions
- Design reliability block diagrams to estimate system availability — redundancy and spare train investment
- Apply risk-based inspection logic to set inspection scope and intervals — the inspection manager
- Test whether safety instrumented functions meet target safety integrity levels — the process safety authority
- Communicate a ranked risk register with options and costs — the integrity budget committee

## Key Risk and Reliability Assessment for Asset Integrity Terms

- FMECA — failure modes, effects and criticality analysis, a structured worksheet ranking how each component can fail and how severe that failure is.
- Fault tree — a logic diagram that combines basic failures through AND and OR gates to calculate the frequency of an unwanted top event.
- Event tree — a branching diagram that follows an initiating event through safeguards to estimate the frequency of each outcome.
- Reliability block diagram — a model of series and parallel components used to calculate the availability of a system.
- Probability of failure on demand — the chance that a protective function fails to act when a hazardous condition arises.
- Risk-based inspection — a method that sets inspection scope and frequency from the probability and consequence of equipment failure.

## Risk and Reliability Assessment for Asset Integrity Day by Day

### Day 1: Integrity Risk in Context

- Asset Integrity Lifecycle — Design, Operation, Inspection and Life Extension
- Risk Matrices and Tolerability Criteria — Setting Corporate Acceptance Limits
- Qualitative Versus Quantitative Assessment — Choosing the Right Depth
- Major Accident Case Lessons — Refining, Offshore and Chemical Examples
- Integrity Risk Register Structure — Linking Hazards, Barriers and Owners

### Day 2: Reliability Data and Statistics

- Failure Rate Sources — Plant History, Industry Databases and Vendor Data
- Exponential and Weibull Models — Constant and Wear-Out Failure Patterns
- Mean Time Between Failures and Repair Times — Availability Inputs
- Data Quality Screening — Censored Records and Small Samples
- Uncertainty and Confidence Bounds — Communicating Estimate Limits

## Day 3: HAZOP as a Risk Input

- IEC 61882 Study Structure — Nodes, Guidewords and Deviations
- Scenario Extraction From HAZOP Records — Causes, Consequences and Safeguards
- Initiating Event Frequencies — Assigning Values to HAZOP Causes
- Consequence Categories — Safety, Environment, Production and Asset Damage
- Action Tracking From Hazard Studies — Closing Findings With Evidence

## Day 4: FMECA for Process Equipment

- IEC 60812 Worksheet Design — Functions, Failure Modes and Effects
- Criticality Ranking Methods — Risk Priority Numbers and Criticality Matrices
- Detection and Mitigation Columns — Linking Failure Modes to Tasks
- FMECA for Rotating and Static Equipment — Pumps, Compressors and Vessels
- FMECA Facilitation — Running Sessions With Operations and Maintenance

## Day 5: Fault Tree Analysis

- Fault Tree Construction — Top Events, Gates and Basic Events
- Minimal Cut Sets — Identifying the Weakest Combinations
- Quantification of Fault Trees — Frequencies and Probabilities Through Gates
- Common Cause Failures — Beta Factor Treatment of Redundant Items
- Importance Measures — Ranking Contributors for Improvement Spend

## Day 6: Event Trees and Consequence Modelling

- Event Tree Construction — Initiating Events and Safeguard Branches
- Outcome Frequencies — Fires, Explosions and Toxic Releases
- Consequence Estimation Basics — Release Rates and Impact Zones
- Bow-Tie Integration — Joining Fault Trees and Event Trees
- Individual and Societal Risk Measures — Presenting Results to Decision Makers

## Day 7: Reliability Block Diagrams and Availability

- Series, Parallel and k-out-of-n Configurations — System Reliability Logic
- Availability Calculation — Failure and Repair Inputs Combined
- Redundancy Options Appraisal — Spare Trains Versus Single Equipment
- Monte Carlo Simulation — Production Availability for Complex Units
- Maintenance Effects on Availability — Testing and Overhaul Downtime

## Day 8: Risk-Based Inspection

- Damage Mechanism Review — Corrosion, Cracking and Erosion Screening
- Probability of Failure Estimation — Damage Rates and Inspection Effectiveness
- Consequence of Failure Estimation — Fluid, Inventory and Location Factors
- Inspection Planning From Risk Ranking — Scope, Method and Interval
- Integrity Operating Windows — Process Limits That Protect Equipment

## Day 9: Safety Integrity Concepts

- Safety Instrumented Functions — Sensors, Logic Solvers and Final Elements
- Safety Integrity Level Targets — Risk Reduction Required per Function
- Probability of Failure on Demand Calculation — Proof Test Intervals and Architecture
- Proof Testing and Bypass Management — Preserving Achieved Integrity
- Barrier Health Monitoring — Tracking Degraded Safeguards Over Time

## Day 10: Practising the Process Unit Risk and Reliability Assessment

- Hazard Scenarios and FMECA Results Applied — Defining the Critical Equipment List
- Fault Tree and Event Tree Results Applied — Quantifying Top Scenarios
- Availability and Inspection Findings Applied — Setting Redundancy and Inspection Priorities
- Safety Integrity Checks Applied — Confirming Protective Function Targets
- Process Unit Risk and Reliability Assessment Completion — Ranked Risks, Actions and Costs

## Applying Risk and Reliability Assessment for Asset Integrity After the Course

- Build a fault tree for one recent unplanned trip, find its minimal cut sets and propose the cheapest change that removes the weakest combination.
- Re-rank the inspection plan for one process unit using probability and consequence of failure and record the intervals that change.

## Risk and Reliability Assessment for Asset Integrity Questions FAQ

### What is risk and reliability assessment for asset integrity and why does it matter now?

Risk and reliability assessment for asset integrity is the use of FMECA, fault trees, event trees, availability models and risk-based inspection to quantify equipment failure. It matters now because refineries, gas plants and chemical sites run longer between shutdowns on tighter budgets.

### Which roles gain most from risk and reliability assessment for asset integrity?

Reliability, safety and risk engineers and asset integrity managers gain most. They decide inspection scope, redundancy and protective function targets, so shared quantitative methods let them defend those decisions with the same data.

### How does risk and reliability assessment for asset integrity differ from a hazard study leadership course?

It quantifies what hazard studies identify. A hazard study leadership course trains facilitators to run sessions; here participants turn scenarios into frequencies, availability figures and inspection priorities for whole process units.

## What do you bring back from risk and reliability assessment for asset integrity training?

You bring back an assessment of one process unit. It includes a critical equipment list, quantified fault and event trees, an availability model, risk-ranked inspection priorities and protective function checks.

## Risk and Reliability Assessment for Asset Integrity: The Way Forward

The Process Unit Risk and Reliability Assessment gives integrity managers one ranked view of failure scenarios, their frequencies and the actions that reduce them. Its first decision is which inspection and redundancy actions enter the coming integrity budget. Reliability and inspection engineers keep it current. After the next shutdown, revisit failure rates against the damage found.