

Course No. 1519

Safety Instrumented Systems (SIS) Training Course

PROCESS SAFETY & LOSS PREVENTION
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Safety Instrumented Systems (SIS) Training Course provides a comprehensive and practical framework for understanding, designing, operating, maintaining, testing, and managing safety instrumented systems in industrial and process environments. The course focuses on the role of safety instrumented systems in reducing operational risk by detecting hazardous conditions and initiating predefined protective actions when normal process control systems are unable to maintain the process within safe operating limits.

The program examines the architecture, functionality, lifecycle, and management requirements of safety instrumented systems and their relationship with process control systems, field instrumentation, shutdown systems, alarms, and other independent protection layers. Participants will develop a clear understanding of how safety instrumented functions are identified, specified, designed, implemented, verified, validated, operated, tested, and maintained throughout the system lifecycle.

A strong technical emphasis is placed on safety instrumented functions, safety requirements, safety integrity, sensors, logic solvers, final elements, redundancy, diagnostics, proof testing, bypass management, failure analysis, and system availability. The course also explores how engineering decisions and maintenance practices influence the ability of an SIS to perform its intended protective function when required.

Through practical industrial scenarios, technical exercises, and structured workshops, participants will develop the ability to assess SIS architectures, review safety requirements, analyze potential failures, evaluate testing and maintenance strategies, and identify opportunities to improve system reliability and functional safety performance. The course is particularly relevant to high-hazard environments where reliable protective systems are essential to controlling process risks and supporting safe operations.

Objectives

- Analyze the purpose, architecture, and operating principles of Safety Instrumented Systems during the course.
- Evaluate the relationship between Safety Instrumented Systems, process control systems, alarms, and independent protection layers.

- Identify Safety Instrumented Functions and translate process hazards into appropriate safety requirements.
- Assess the functional requirements of sensors, logic solvers, and final control elements within an SIS.
- Apply principles for developing and reviewing Safety Requirements Specifications.
- Evaluate safety integrity requirements and their influence on SIS architecture and design.
- Analyze failure modes, diagnostic capabilities, redundancy, and common cause considerations affecting SIS performance.
- Develop effective approaches for proof testing, inspection, maintenance, bypass management, and system lifecycle control.
- Evaluate SIS performance, reliability, testing results, and maintenance practices to identify potential weaknesses.
- Develop an actionable improvement plan for the management, operation, maintenance, and lifecycle assurance of safety instrumented systems.

Who Should Attend

The Safety Instrumented Systems (SIS) Training Course is designed for engineers and professionals working in functional safety, process safety, instrumentation and control, automation, electrical engineering, operations, maintenance, reliability, and industrial risk management. It is particularly relevant to instrumentation engineers, control engineers, automation engineers, process safety engineers, functional safety engineers, electrical engineers, reliability engineers, maintenance engineers, process engineers, and technical specialists responsible for safety-related systems.

The course is also suitable for engineering managers, process safety managers, operations managers, maintenance managers, reliability managers, project managers, asset managers, technical authorities, HSE professionals, auditors, and senior decision makers involved in the design, approval, operation, maintenance, testing, or assurance of safety instrumented systems. It is highly relevant to government entities, ministries, oil and gas organizations, refineries, petrochemical facilities, chemical plants, energy companies, utilities, manufacturing facilities, and other high-hazard industrial operations.

Learning Outcomes

- Explain the purpose, architecture, and lifecycle of Safety Instrumented Systems.
- Distinguish between basic process control functions and independent safety instrumented functions.
- Identify hazardous scenarios requiring safety instrumented protection.
- Define the main components and functional requirements of sensors, logic solvers, and final elements.
- Develop and review key elements of a Safety Requirements Specification.
- Evaluate safety integrity requirements and their relationship to SIS architecture.
- Analyze failure modes, diagnostic coverage, redundancy, and common cause effects on SIS performance.
- Develop practical proof-testing, maintenance, inspection, and bypass-management strategies.
- Evaluate SIS reliability and performance using testing, maintenance, and operational information.
- Prepare a practical SIS lifecycle improvement plan covering design, operation, testing, maintenance, management of change, and functional safety assurance.

Course Outline

DAY 01

Safety Instrumented Systems Fundamentals and Industrial Risk

- Introduction to Safety Instrumented Systems and functional safety
- Role of SIS in industrial risk reduction
- Relationship between SIS and process safety
- Basic Process Control Systems and Safety Instrumented Systems
- Independent Protection Layers
- Hazardous scenarios and safety-related functions
- Safety Instrumented Functions and protective actions
- SIS architecture and major components
- Sensors, logic solvers, and final elements

DAY 01 — CONTINUED

PRACTICAL APPLICATION

Analyze a representative process and identify hazardous scenarios, protection layers, and potential Safety Instrumented Functions

DAY 02**SIS Requirements, Architecture, and Safety Integrity**

- Safety lifecycle and SIS management
- Identification and allocation of Safety Instrumented Functions
- Safety Requirements Specification
- Functional and safety requirements
- Safety Integrity Level concepts
- Risk reduction requirements
- SIS architecture selection
- Redundancy and voting arrangements
- Diagnostic capabilities and system availability

PRACTICAL APPLICATION

Develop a simplified Safety Requirements Specification and evaluate an appropriate SIS architecture for selected safety functions

DAY 03**SIS Design, Failure Analysis, and Performance**

- Design principles for safety instrumented systems
- Sensor selection and configuration
- Logic solver functionality
- Final elements and shutdown devices
- Failure modes and failure behavior
- Safe and dangerous failure concepts
- Diagnostic coverage and fault detection

DAY 03 — CONTINUED

- Common cause and common mode failures
- Independence and separation requirements

PRACTICAL APPLICATION

Analyze a Safety Instrumented Function and identify potential failure modes, diagnostic requirements, redundancy options, and performance considerations

DAY 04

SIS Testing, Maintenance, and Lifecycle Management

- Proof testing principles and objectives
- Proof-test planning and intervals
- Inspection and maintenance requirements
- Bypass and override management
- Functional testing and validation
- Failure reporting and corrective actions
- SIS availability and reliability
- Configuration management and documentation
- Management of change for safety instrumented systems

PRACTICAL APPLICATION

Develop a proof-testing and maintenance strategy for a representative SIS and evaluate the impact of testing intervals and bypasses on system performance

DAY 05

SIS Assessment, Assurance, and Continuous Improvement

- Evaluating SIS performance and reliability
- Reviewing safety integrity requirements
- SIS verification and validation
- Functional safety assessments and technical assurance
- SIS audit principles and lifecycle compliance

DAY 05 — CONTINUED

- Operational performance monitoring
- Incident investigation and lessons learned
- Modernization and lifecycle improvement
- Developing SIS performance indicators

FINAL WORKSHOP

Develop a complete SIS lifecycle improvement plan covering requirements, architecture, design, testing, maintenance, bypass management, change control, assurance, and continuous improvement

Register or Request More Information

Course page: <https://quest-training.com/courses/safety-instrumented-systems-sis-training-course>

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