Functional Safety Engineering for SIS and SIL Training Course

30 Nov - 04 Dec 2026

Tokyo

5800 € (Per Person)

Ref: #ACE8384_197402

Course Introduction / Overview:

This course provides a comprehensive and practical understanding of Safety Instrumented Systems (SIS) and the complete safety lifecycle as defined by international standards IEC 61511 and IEC 61508. In high-hazard industries, the prevention of catastrophic events is paramount, and a robust SIS is the last line of defense. This training moves beyond mere theory to equip participants with the skills needed for the specification, design, analysis, and management of these critical systems. We will delve into the core principles of functional safety, exploring concepts discussed by leading experts like David Macdonald in works such as "Practical SIL Target Selection". The curriculum covers everything from initial Process Hazard Analysis (PHA) and Layer of Protection Analysis (LOPA) to the detailed calculation and verification of Safety Integrity Levels (SIL). BIG BEN Training Center has designed this program to bridge the gap between understanding the standards and applying them effectively in real-world projects. Participants will learn to develop a coherent Safety Requirement Specification (SRS), perform SIL verification calculations, and understand the crucial role of proof testing, maintenance, and operational management in sustaining safety integrity over the system's entire lifespan, ensuring both compliance and enhanced operational safety.

Target Audience / This training course is suitable for:

- Process Safety Engineers.
- Control and Instrumentation Engineers.
- Automation and Electrical Engineers.
- Project Managers involved in SIS projects.
- Operations and Maintenance Supervisors.
- Plant Managers and Technical Managers.
- HSE Professionals and Risk Assessment Specialists.
- Engineering Team Leaders.
- System Integrators and Engineering Consultants.

Target Sectors and Industries:

- Oil and Gas (Upstream, Midstream, and Downstream).
- Chemical and Petrochemical Processing.
- Pharmaceutical Manufacturing.
- Power Generation and Utilities.
- Pulp and Paper Industries.
- Mining and Mineral Processing.
- Water and Wastewater Treatment Facilities.
- Governmental regulatory bodies and safety agencies.

Target Organizations Departments:

- Engineering and Design.
- Process Safety Management (PSM).
- Operations and Production.
- Maintenance and Reliability.
- Health, Safety, and Environment (HSE).
- Projects and Commissioning.
- Technical and Plant Management.
- Instrumentation and Control.

Course Offerings:

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

- Understand the principles of the SIS safety lifecycle according to IEC 61511.
- Participate effectively in Hazard and Operability (HAZOP) studies.
- Apply Layer of Protection Analysis (LOPA) for risk assessment.
- Determine the required Safety Integrity Level (SIL) for safety functions.
- Develop a comprehensive Safety Requirements Specification (SRS).
- Calculate the Probability of Failure on Demand (PFD) for a SIF.
- Perform SIL verification for proposed safety system designs.
- Specify requirements for SIS installation, commissioning, and validation.
- Develop strategies for proof testing and maintenance of SIS components.
- Manage changes to a Safety Instrumented System effectively.

Course Methodology:

The training methodology at BIG BEN Training Center is centered on creating an immersive and practical learning environment that goes beyond traditional lectures. This course utilizes a blended approach, combining expert-led instruction with interactive workshops, group discussions, and detailed case study analysis. Participants will engage with real-world scenarios drawn from various process industries, allowing them to apply concepts like LOPA and SIL verification in a tangible context. The program emphasizes hands-on exercises, including the development of a Safety Requirements Specification (SRS) and the calculation of PFDavg for different SIF loop architectures. Our instructors foster a collaborative atmosphere where participants can share their own professional experiences and challenges, enriching the learning for all attendees. Continuous feedback is provided throughout the sessions to ensure a solid grasp of complex topics like systematic capability and common cause failure analysis. This active learning approach ensures that participants not only understand the theory behind functional safety standards but also gain the confidence to apply these critical skills in their own operational environments immediately upon returning to work.

Course Agenda (Course Units):

Unit One: Foundations of Functional Safety and SIS

- Introduction to process safety management.
- Accidents and the role of Safety Instrumented Systems (SIS).
- Overview of functional safety standards IEC 61508 and IEC 61511.
- The concept of risk and risk reduction.
- Understanding the complete SIS safety lifecycle.
- Defining Safety Instrumented Functions (SIF).
- Key terminology and definitions in functional safety.

Unit Two: Hazard Identification and Risk Assessment

- Process Hazard Analysis (PHA) methodologies.
- Deep dive into Hazard and Operability (HAZOP) studies.
- Identifying potential hazardous events and consequences.
- Introduction to Layer of Protection Analysis (LOPA).
- Evaluating Independent Protection Layers (IPLs).
- Qualitative and quantitative risk assessment techniques.
- Documenting hazard and risk assessment results.

Unit Three: Safety Integrity Level (SIL) Determination

- The concept of Safety Integrity Level (SIL).
- Different methods for SIL determination (Risk Matrix, Risk Graph).
- Detailed application of LOPA for SIL assignment.
- Defining tolerable risk and setting risk targets.
- Developing the Safety Requirements Specification (SRS).
- Specifying functional and integrity requirements for each SIF.
- Practical workshops on SIL determination.

Unit Four: SIS Design, Engineering, and SIL Verification

- SIF loop components (sensors, logic solvers, final elements).
- Architectural constraints and hardware fault tolerance (HFT).
- Understanding Probability of Failure on Demand (PFDavg) and PFH.
- Calculating PFDavg for different architectures (1oo1, 1oo2, 2oo3).
- Systematic capability and its importance in design.
- SIL verification and validation processes.
- Documentation requirements for SIS design.

Unit Five: SIS Lifecycle Management and Operational Excellence

- SIS installation, commissioning, and validation procedures.
- The critical role of proof testing and developing test plans.
- SIS operation, maintenance, and bypass management.
- Management of Change (MOC) for Safety Instrumented Systems.
- Functional Safety Assessment (FSA) stages.
- Understanding human factors in functional safety.
- Strategies for long-term SIS performance and reliability.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

Beyond quantitative calculations like PFDavg, how can an organization effectively manage the systematic and human-factor risks that contribute to safety system failures?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by focusing on the holistic and practical application of the entire SIS safety lifecycle, rather than concentrating on isolated elements like SIL calculation. While many programs may teach the theory, this training emphasizes the "how" and "why" behind each stage of IEC 61511, from initial hazard analysis to long-term maintenance and eventual decommissioning. We move beyond software-driven calculations to build a deep, foundational understanding of risk, enabling participants to make sound engineering judgments. The curriculum is built around real-world case studies that illustrate the consequences of both success and failure in SIS design and management. Our approach ensures that participants learn not just to comply with standards, but to engineer genuinely safer processes. The course uniquely bridges the gap between the engineering department, operations, and maintenance, fostering a unified understanding of how each role contributes to sustained functional safety. Participants leave with a comprehensive skill set that allows them to manage SIS projects, contribute meaningfully to safety assessments, and champion a culture of process safety within their organizations.