Safety Instrumented Systems
For Technicians
[SIST]

Course Overview

Length: 2-days (16 hrs)

Hands-On: 25-35%

Target Audience: Maintenance personnel responsible for performing maintenance, testing, and calibration work on Safety Instrumented Systems (SIS). Typical students include: Instrument Technicians, SIS Technicians, I&E Technicians, and Automation Personnel.

Summary Description: This course introduces students to the maintenance aspects of IEC 61511 (Safety Instrumented Systems. The primary targets of this course are instrument and automation technicians who maintain, troubleshoot, and repair safety instrumented systems. The course assumes technicians have basic understanding of instrumentation and controls but does reinforce key areas that often lead to problems and mistakes in SIS maintenance. Students will gain familiarity with the overall SIS program to help them understand their role and responsibilities in the program, as well as detailed coverage of maintenance related issues of IEC 61511 including proper proof testing of typical instrumentation devices.

Course Agenda:

Day 1

- Process safety (in general)
- Big picture view of IEC 61508 and 61511 (ISA 84) programs, including how they are coordinated and how they relate to other process safety related programs
- Understand SIS terminology (SIS, SIF, SIL, LOPA, HOA, PFD, RRF, etc.)
- Process of risk ranking and assignment of SIL ratings (from HAZOP's, & LOPA's, and development of Safety Requirement Specs)
- Layers of Protection and LOPA
- Safety Lifecycles
- Common SIF failures
- Demand tracking in SIS
- Understanding Probability of Failure on Demand (PFD)
- Impacts of maintenance on PFD & Average PFD
- SIF Device Failure Tracking and impact on Risk Reduction Factor (RRF) requirements & SIL Ratings
- Understanding impact on Demand Tracking and impact on RRF & SIL Ratings
- Recognizing Failure types (Safe/Dangerous; Detected/Undetected)
- Understand PASS/FAIL criteria and common mistakes and errors

DAY 2

- Understanding Modern Instrumentation used in SIS systems (HART/SMART, diagnostics, Control System features, etc.)
- Recognizing likely failure points in a SIF
- Typical Proof Testing (in detail)
- Practice completing typical SIF procedures and forms
- Types and approaches to SIS proof testing
- Recognize and be able to identify common faults and failures in SIS equipment
- Be aware of common errors and mistakes made in SIS testing and maintenance and understand the impact on overall program and safety margins.

Hands-On Exercises (only major items or group titles listed):

This course is approximately 25-35% hands-on training. The course will utilize Rosemount Smart transmitters connected to a typical controller input with scaling and other typical details. Students will use a variety of common instrumentation test and calibration equipment such as Fluke process meters / calibrators, and HART Communicators to perform actual typical SIS maintenance tasks and proof testing, and allow students to dig deep into the real world issues, mistakes, and common problems that are encountered in the field. Students will also do various analysis and have team and group discussions related to risk ranking determinations, LOPA selections, SRS details, and other SIS program details in order to better understand how the overall SIS program is organized.

The primary objective of the course is to ensure that students understand how to perform SIS maintenance properly and in accordance with IEC 61511. This course will cover all of the underlying concepts that even many senior technicians do not fully understand related to modern I&C devices used in Safety Instrumented Functions (SIFs), that often cause mistakes and oversights during SIS testing which can compromise the process safety of the plant or system.

For customized onsite delivery of this course, coverage of specific logic solvers (controllers) and final control elements such as SIS valves or ESD devices is often included as well.

Some of the typical hands-on exercises for this course include:

- Observe types of instrument failures (to help understand reasons for SIS proof test steps)
- High/Low Fault tests
- Instrument inspections
- Proof testing of typical Smart Instrumentation
- Common instrumentation failures, mistakes, misconfigurations, etc.

Student Outcomes (Course Objectives)

- Understand the big picture of how and why IEC 61508 and 61511 (ISA 84) was developed and how they help ensure safety margins.
- Become familiar with common SIS terminology and basic concepts.
- Understand how SIS programs are developed.
- Understand how Layers of Protection (LOPA) are selected and implemented, and be aware of precautions and technician responsibilities to ensure design objectives of SIS programs are satisfied.
- Understand how risk-ranking and assignment of SIL ratings are determined.
- Realize the value and benefit of a well organized SIS program and it's impact on safety margins.
- Understand technician roles and responsibilities related to SIF device testing and failure tracking.
- Be familiar with SIS testing and maintenance regimens and understand the coordination of partial testing and full proof testing.
- Recognize failure types for SIS systems (Safe/Dangerous; Detected/Undetected).
- Understand different approaches and strategies for SIS testing.
- Understand and follow typical SIS testing procedures.
- Recognize the steps and the importance of a proper instrument 'Inspection' during SIS testing.
- Be able to realize and respond to weaknesses in SIS programs and procedures.

- Be familiar with common mistakes, misconceptions, and problems associated with SIS program maintenance, testing, and calibrations.
- Develop a clear understanding of how SIS testing differs from typical I&C calibration and testing and be able to apply the principles of IEC 61511 (ISA 84) to achieve desired SIS program objectives.
- Recognize the real value and power of an SIS program.

Team / Organizational Benefits:

- More efficient performance of SIS maintenance and testing.
- Reduce mistakes during SIS maintenance.
- Ensure safety critical systems are achieving design safety performance.
- Help personnel understand the value and power of a well operated SIS program so they can better engage and help achieve SIS program goals (help them understand how and why it is more than just *another safety program*).