



## SAFETY INTEGRITY LEVEL (SIL) VERIFICATION

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### Program Content:

This 2-day course covers the performance verification of Safety Instrumented Functions (SIF), including calculation of the Probability of Failure on Demand (PFD) and Spurious Trip Rate (STR). These calculations must take into account the device failure rates, system architecture, subsystem voting configuration, specified diagnostics and testing, and repair times. The PFD calculation must also take into account the susceptibility of the SIF to common mode and common cause failure.

IEC 61511 requires that the PFD be verified by calculation to prove that each SIF meets its target Safety Integrity Level (SIL). This course provides students with an understanding of the fundamentals needed to address this requirement in their workplace. It familiarizes students with Failure Modes and Effects Analysis (FMEA), the identification of safe, dangerous, detected, and undetected device failures, the selection of failure rate data, understanding key design parameters, and applying the calculation methodology. The two approaches for approving a device for use in an SIS - certification and prior use - are also explained.

The course presents a series of examples as workshops to illustrate the important concepts and assumptions implicit in the calculations. **The student must bring a scientific calculator and notepad to the course.**

- Overview of the requirements in the SIS standards
- Failure analysis fundamentals
- Failure Modes and Effects Analysis (FMEA)
- Introduction to the math for probability of failure on demand and spurious trip rate
- Key elements affecting performance
- Workshops -- problems worked by students. Various cases will be modeled showing how changes to design and maintenance strategy affect results.

### Who Should Attend?

Control systems engineers, instrument engineers, and process safety specialists



## SIL Verification Course Outline

### 1<sup>st</sup> Day

- Overview of SIS standards
- Failure fundamentals - Failure Modes and Effects Analysis (FMEA)
- Introduction to the math for probability of failure on demand and spurious trip rate
- Key Elements
  - Integrity – where do you get data from? What does it mean?
  - Voting/Fault Tolerance – why do you need redundancy? How does it help?
  - Test Interval – how does the test interval affect the integrity?
  - Diagnostic Coverage – what effect does diagnostics have?
  - Common Cause – how is this modeled?
- Periodic Workshops throughout the day
  - How to read manufacturer certification reports
  - How to model SIF based on LOPA recommendations
  - Understanding mean time to failure and useful life
  - Partial stroke testing and proof test coverage

### 2<sup>nd</sup> Day

- Example System
  - Impact of diagnostics and need for compensation measures
  - Calculation demonstration showing the impact of redundancy
- Workshops -- problems worked by students. Various cases will be modeled showing how changes to design and maintenance strategy affect results.

Time: 1<sup>st</sup> Day - 8:30am to 4:30pm  
2<sup>nd</sup> Day - 8:30am to 3:30pm

CEUs: 1.4