TECHNICAL
EDUCATION
ACADEMY

Operational Risk Management Center

COURSE PROGRAMME

000630

HSSE089 - Safety Instrumented Systems

Are you involved in determining SIL levels or designing SIS?



Learn from the Best in the Business!

Course overview

Intermediate level

Why take this course

Are you involved in determining SIL levels or designing SIS? Do you think that too many SIS (or too high of SIL ratings) are being recommended for your site? Do you just want to understand what SIS are and where they fit in to control risk and how these are specified, designed, installed, and maintained? Do you want to know how human error dominates the ACTUAL performance in the field of installed SIS? Then this is the course for you.

This course explains SIS from the ground up and explains how these have replaced the definitions of emergency shutdowns (ESDs) and how they different from basic process control systems, such as a DCS. This course differs from others in that you will also learn the state of the art in SIL Verification (and Design) calculations, including how to account for systemic errors caused by human error; these can dominate the failure rate for SIL 2 and SIL 3 systems.

The course covers all aspects of how to apply this very useful technique. Workshops are used as the primary mode of teaching for SIF design and SIL Verification. You will perform several complete SIL Verifications before leaving class.

Recommended prerequisites: Attendees should have strong technical skills and prior training in PHA/HAZOP and LOPA for determining SIL requirements.

Who it is for and how it helps

Managers – Operations, Safety and Executive, Engineers – Process, Safety and Mechanical, Compliance Auditors, Environmental Management and Technicians.

What you will learn

- Learn what is a safety instrumented function (SIF) and safety integrity level (SIL)
- Learn how to determine if a SIF is needed or not, and especially learn if the the other independent protection layers are sufficient for controlling risk to as low as reasonably practical (ALARP)
- Apply minimal requirements from international SIS standards such as ANSI/ISA 84 and IEC 61511
- Learn how to specify and design SIS to meet the required functions and SIL
- Learn how to verify the SIL for a design
- Apply requirements for installation and validation of the SIS
- Learn about requirements for ongoing inspection, testing, and maintenance of SIS

Curriculum

Modules 01–04

01 Introduction to SIS

- Learning objectives and goals of using SIS
- History of SIS and basic definitions
- Where does SIS fit with other ways to control process risk?
- Relationship of SIS to ESD and basic process control systems (BPCS), such as field PLCs, relays, and DCS
- What are safety integrity levels (SILs) and what are the basic requirements for SIL 1, 2, and 3
- Lifecycle of SIS
- Overview of related international standards, ANSI/ISA 84 and IEC 61511 (and 61508)
- Overview of human factors and the impact of human error on SIS.

02 Determining the need for Safety Instrumented Function (SIF)

- Evaluating all IPLs using qualitative (brainstorming) hazard evaluations methods (such as HAZOP), semi-quantitative methods (such as LOPA and Risk Graphs), and quantitative methods (such as fault tree analysis)
- Determining the risk reduction to allocate to the SIF (if any), which in turn specifies the SIL
- Determining the need for SIF and the related SIL from a HAZOP report

03 Specifying the SIF and Designing the Related SIS

- Determining the process requirements, such as how the process will be brought to safe state, in what order of steps, and with what delays, and also how the process will be restarted after a trip.
- Using the process requirements to develop the Safety Requirements Specification (SRS)

04 Designing the SIS to meet the required SIL

- Basic reliability terms (such as failure rates, MTTF, MTTR, and MART) and limitations of reliability data
- Basic reliability equations and converting between failure rates and probability of failures on demand (PFD)
- Options for improving SIL rating of a base design, including use of redundancy, changing test intervals, changing reliability of base components, and reducing chances for systemic errors (especially human errors)
- Basic SIL calculations

Curriculum

Modules 04–07 · Module 04 — continued

- Using redundancy to improve SIL rating
- Using shorter test intervals to improve SIL rating

05 Estimating the PFD of a SIF to Verify the SIL

- Definitions, rules, and exceptions for determination of SIL
- Using a look-up tables of reliability data and PFDs
- Calculations using simple equations
- Extending calculations on Workshops 3 and 4 to include systemic failure probability
- Calculations using other methods, such as Fault Tree and Markov analyses

06 SIS fabrication, installation, and start-up

- Issues for fabrication and vendor qualifications
- Installation issues, especially related to maintainability and survivability and and limit common cause failures
- Startup and initial validation test, leading to site acceptance test (SAT)

07 SIS maintenance and proof testing (validation) for the life of the SIS

- Maintenance planning and procedures
- Proof testing and record-keeping requirements for ongoing SIL Validation
- Industry example of SIS and issues with each
- Specialized SIS designs: HIPPS, Burner Management Systems (BMS)
- Pulling it all together from beginning to end

Participation and contacts

Joining the programme

Contact the Academy and quote course code 000630 to confirm dates, delivery format, prices and enrolment terms.

Training for your team

Tell us your business goals, the roles and number of participants, and your preferred dates and location. This will help us discuss the right training option.

Preparing for the programme

The published programme does not specify any prerequisites. Contact us before enrolling to confirm how to prepare.

Discuss your training needs

mail@tecedu.org
www.tecedu.academy

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