COURSE OVERVIEW IE0403

SIL Determination & Hazard Assessment

Course Title
SIL Determination & Hazard Assessment

Course Date/Venue
Session 1: May 26-30, 2024/Oryx Meeting Room, DoubleTree By Hilton Doha-Al Sadd, Doha, Qatar
Session 2: October 06-10, 2024/Oryx Meeting Room, DoubleTree By Hilton Doha-Al Sadd, Doha, Qatar

Course Reference
IE0403

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of SIL Determination and Hazard Assessment. It covers the role of SIS in hazard mitigation and the definition and purpose of SIL; the relevant safety standards covering IEC 61508 and IEC 61511; the risk and safety management, hazard and operability study (HAZOP), failure mode and effects analysis (FMEA) and layers of protection analysis (LOPA); the risk reduction and SIL selection as well as initiating events, consequences, and existing safeguards.

Further, the course will also discuss the risk graphs for SIL determination, verification process and the design principles and architectures that influence SIL levels; how quantitative risk assessment (QRA) supports SIL determination; the advanced HAZOP and FMEA techniques, fault tree analysis (FTA) and event tree analysis (ETA); the dynamic risk assessments and safety requirements specification (SRS) for SIS; and the impact of human error and organizational factors on safety.

During this interactive course, participants will learn the SIL verification process and techniques including reliability analysis for SIS components; the software tools used in the industry for SIL verification and reliability calculations; the functional safety assessment and auditing, management of change and best practices for integrating SIS design and SIL considerations into daily operation; the effective strategies for the operation and maintenance of SIS; monitoring SIS performance including SIL performance indicators and continuous improvement practices; conducting incident investigations and using findings to improve safety and SIL determinations; the SIS lifecycle from concept to decommissioning; and the importance of lifecycle management for maintaining SIL.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on SIL determination and hazard assessment
- Discuss the role of SIS in hazard mitigation and the definition and purpose of SIL
- Explain the relevant safety standards covering IEC 61508 and IEC 61511
- Carryout risk and safety management, hazard and operability study (HAZOP), failure mode and effects analysis (FMEA) and layers of protection analysis (LOPA)
- Apply risk reduction and SIL selection as well as identify initiating events, consequences, and existing safeguards
- Use risk graphs for SIL determination and their application in different scenarios
- Implement verification process to ensure SIL targets are achievable with selected SIS designs
- Discuss the design principles and architectures that influence SIL levels
- Exploring how quantitative risk assessment (QRA) supports SIL determination and its application in complex scenarios
- Employ advanced HAZOP and FMEA techniques as well as fault tree analysis (FTA) and event tree analysis (ETA)
- Apply dynamic risk assessments and develop safety requirements specification (SRS) for SIS based on hazard assessments and SIL determinations
- Discuss the impact of human error and organizational factors on safety and how to mitigate these risks
- Carryout SIL verification process and techniques including reliability analysis for SIS components
- Recognize the software tools used in the industry for SIL verification and reliability calculations
- Apply functional safety assessment and auditing, management of change and best practices for integrating SIS design and SIL considerations into daily operation
- Develop effective strategies for the operation and maintenance of SIS to ensure ongoing SIL compliance

- Monitor SIS performance including SIL performance indicators and continuous improvement practices
- Conduct incident investigations and use findings to improve safety and SIL determinations
- Discuss SIS lifecycle from concept to decommissioning and the importance of lifecycle management for maintaining SIL

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of SIL determination and hazard assessment for senior process control engineers, senior control systems engineers, process control engineers, process engineers, control systems engineers, reliability and integrity engineers as well as safety engineers, professionals and regulators.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US$ 5,500 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Sydney Thoresson, PE, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **40 years** of extensive experience within the **Petrochemical**, **Utilities**, **Oil**, **Gas** and **Power** industries. His specialization highly evolves in **Process Control Instrumentation**, **Process Instrumentation & Control**, **Process Control**, **Instrumentation**, Troubleshooting & Problem Solving, Instrumentation Engineering, Process Control (**PCI**) & Safeguarding, **Instrument Calibration & Maintenance**, **Instrumented Safety Systems**, High Integrity Protection Systems (**HIPS**), Process Controller, **Control Loop & Valve Tuning**, **Compressor Control & Protection**, **Control Systems**, Programmable Logic Controllers (**PLC**), **SCADA System**, **PLC & SCADA** - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA**, **PLC-SIMATIC S7 300/400**: Configuration, Programming and Troubleshooting, **PLC, Telemetry and SCADA** Technologies, Cyber Security of Industrial Control System (**PLC, DCS, SCADA & IED**), Basics of **Instrumentation Control System, DCS**, **Distributed Control System** - Operations & Techniques, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, Distributed Control Systems (**DCS**) especially in **Honeywell DCS**, **H&B DCS**, **Modicon, Siemens**, **Telemecanique**, **Wonderware** and **Adrioit,** Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Emergency Shutdown** System, Variable Frequency Drive (**VFD**), **Process Control & Safeguarding**, **Field Instrumentation**, **Instrumented Protective Devices** Maintenance & Testing, Instrumented Protective Function (**IPF**), **Refining & Rotating Equipment**, **Equipment Operations**, **Short Circuit Calculation**, **Voltage Drop Calculation**, **Lighting Calculation**, **Hazardous Area Classification**, **Intrinsic Safety**, **Liquid & Gas Flowmetering**, **Custody Measurement**, **Ultrasonic Flowmetering**, **Loss Control**, **Gas Measurement**, **Flowmetering & Custody Measurement**, **Multiphase Flowmetering**, **Measurement** & **Control** and **Mass Measuring System Batching** (**Philips**). Further, he is also well-versed in **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Log-Out & Tag-Out (**LOTO**), **ALARP & LOPA** Methods, Confined Workspaces, Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators** and **Generator Protection**. He is currently the **Projects Manager** wherein he manages projects in the field of electrical and automation engineering and in-charge of various process hazard analysis, fault task analysis, FMEA and HAZOP study.

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions and dedication as the **Contracts & Projects Manager**, **Managing Director**, **Technical Director**, **Divisional Manager**, **Plant Automation Engineer**, **Senior Consulting Engineer**, **Senior Systems Engineer**, **Consulting Engineer**, **Service Engineer** and **Section Leader** from several international companies such as **Philips**, **FEDMIS**, **AEG**, **DAVY International**, **BOSCH**, **Billiton** and **Endress/Hauser**.

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **Bachelor's** degree in **Electrical & Electronics Engineering** and a **National Diploma** in **Radio Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the International Society of Automation (**ISA**) and the Society for Automation, Instrumentation, Measurement and Control (**SAIMC**). He has further delivered numerous trainings, courses, seminars, conferences and workshops worldwide.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0845	***Introduction to Safety Instrumented Systems (SIS) & SIL:*** *The Role of SIS in Hazard Mitigation & the Definition & Purpose of SIL*
0845 – 0930	***Overview of Relevant Safety Standards:*** *An Introduction to Key Standards such as IEC 61508 & IEC 61511, Outlining their Requirements & Applicability*
0930 – 0945	*Break*
0945 – 1100	***Basic Concepts of Risk & Safety Management:*** *Understanding Risk, Hazard & the Principles of Safety Management*
1100 - 1230	***Hazard Identification Techniques:*** *Introduction to Methods Like HAZOP (Hazard & Operability Study) & FMEA (Failure Mode & Effects Analysis)*
1230 – 1245	*Break*
1245 – 1345	***Layers of Protection Analysis (LOPA):*** *An Overview of LOPA & its Role in SIL Determination*
1345 - 1420	***Risk Reduction & SIL Selection:*** *How SIL Levels Correspond to Risk Reduction & the Basics of Selecting SIL Targets*
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***Detailed Exploration of LOPA:*** *Conducting LOPA including Identifying Initiating Events, Consequences & Existing Safeguards*
0830 - 0930	***SIL Determination Using Risk Graphs:*** *How to Use Risk Graphs for SIL Determination and their Application in Different Scenarios*
0930 – 0945	*Break*
0945 – 1100	***SIL Verification Concepts:*** *Verification Process to Ensure SIL Targets are Achievable with Selected SIS Designs*
1100 – 1230	***SIS Design Considerations for SIL Achievement:*** *Discussing the Design Principles & Architectures that Influence SIL Levels*
1230 – 1245	*Break*
1245 – 1330	***Quantitative Risk Assessment (QRA):*** *How QRA Supports SIL Determination & its Application in Complex Scenarios*
1330 – 1420	***Workshop on SIL Determination:*** *Hands-on Exercises Using Real-World Examples to Apply SIL Determination Methodologies*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Advanced HAZOP & FMEA Techniques:*** *Exploring More Complex Scenarios & Applying These Techniques to Detailed System Analysis*
0830 - 0930	***Fault Tree Analysis (FTA) & Event Tree Analysis (ETA):*** *Understanding these Analytical Methods & their Application in Hazard Assessment*
0930 – 0945	*Break*
0945 – 1100	***Dynamic Risk Assessments:*** *Introduction to Dynamic & Real-Time Risk Assessment Methodologies*
1100 – 1230	***Safety Requirements Specification (SRS) for SIS:*** *The Process of Developing SRS Documents Based on Hazard Assessments & SIL Determinations*
1230 – 1245	*Break*
1245 – 1345	***Human Factors in Hazard Assessment:*** *The Impact of Human Error & Organizational Factors on Safety & How to Mitigate these Risks*
1345 - 1420	***Case Study Analysis:*** *Analyzing Case Studies to Apply Advanced Hazard Assessment Techniques & Draw Lessons Learned*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***SIL Verification Process & Techniques:*** *Detailed Steps for Verifying that SIS Designs Meet the Required SIL Levels*
0830 - 0930	***Reliability Analysis for SIS Components:*** *How to Analyze Component Reliability & Its Impact on Overall SIS Performance*
0930 – 0945	*Break*
0945 – 1100	***Software Tools for SIL Verification & Reliability Analysis:*** *Introduction to Software Tools Used in the Industry for SIL Verification & Reliability Calculations*
1100 – 1230	***Functional Safety Assessment & Auditing:*** *The Principles of Functional Safety Assessment & the Role of Auditing in Ensuring Compliance with SIL Requirements*
1230 – 1245	*Break*
1245 – 1315	***Management of Change & Its Impact on SIL:*** *How Changes in Processes, Systems or Operational Conditions Affect SIL & How to Manage These Changes*
1315 – 1420	***Group Exercise on SIL Verification:*** *Practical Exercise Involving Participants in a Mock SIL Verification Process Using Example Data*
1420 – 1430	***Recap***
1430	*Lunch & End of Day Four*

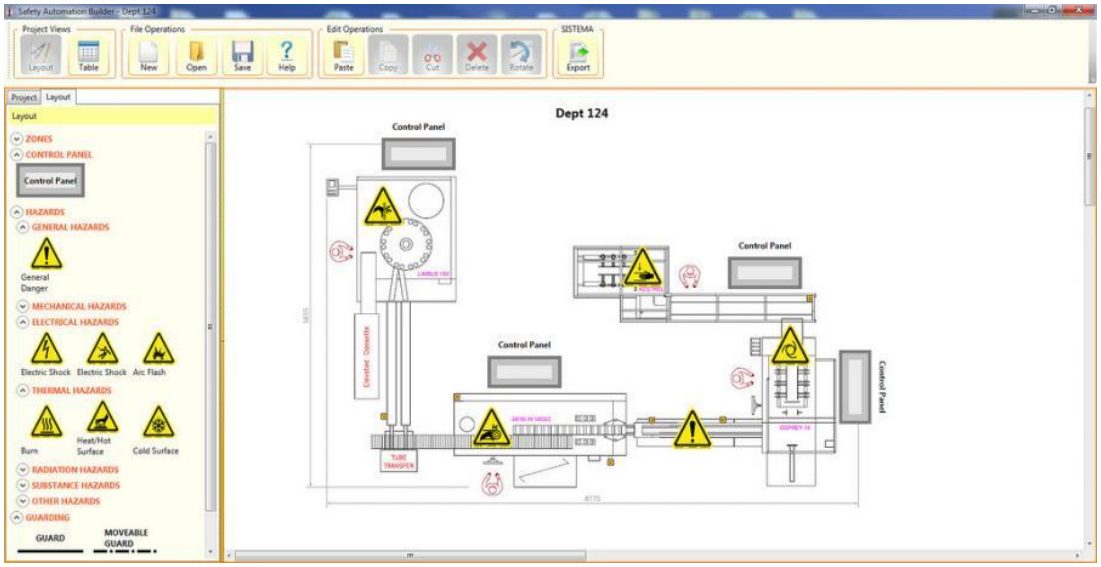
Day 5

0730 – 0900	***Implementing SIS & SIL Requirements in Operations:*** *Best Practices for Integrating SIS Design & SIL Considerations into Daily Operations*
0900 - 0930	***SIS Operation & Maintenance Strategies:*** *Developing Effective Strategies for the Operation & Maintenance of SIS to Ensure Ongoing SIL Compliance*
0930 – 0945	*Break*
0945 – 1145	***Performance Monitoring & Improvement of SIS:*** *Techniques for Monitoring SIS Performance, Including SIL Performance Indicators & Continuous Improvement Practices*
1130 – 1230	***Incident Investigation & Learning from Events:*** *How to Conduct Incident Investigations & Use Findings to Improve Safety & SIL Determinations*

1230 – 1245	*Break*
1245 – 1345	***SIS Lifecycle Management:*** *Overview of the SIS Lifecycle from Concept to Decommissioning & The Importance of Lifecycle Management for Maintaining SIL*
1345 – 1400	***Course Conclusion***
1400 – 1415	***POST-TEST***
1415 - 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using the "Safety Automation Builder Software (Rockwell Automation)" software.



Safety Automation Builder (Rockwell Automation) Software

Course Coordinator

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