COURSE OVERVIEW IE1113
SIL/SCE Instruments Selection

H-STK© INCLUDED

Course Title
SIL/SCE Instruments Selection

Course Date/Venue
September 08-12, 2025/Meeting Plus 9, City Centre Rotana, Doha, Qatar

Course Reference
IE1113

3.0 CEUs (30 PDHs) AWARD

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

Course Description

This practical and highly-interactive course includes 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 knowledge of SIL/SCE Instruments Selection. It covers the functional safety, safety instrumented functions (SIF) and SIS, safety integrity levels (SIL) and safety critical elements (SCEs); the IEC 61508 and IEC 61511 standards, regulatory and industry context, hazard and risk assessment (H&RA), layers of protection analysis (LOPA) and safety requirements specification (SRS); the SIF demand mode and architecture and the functional safety assessment (FSA) and interfaces with BPCS and other systems.

During the course, participants will be able to the general considerations in instrument selection, pressure, level, temperature instruments, flow instruments for SIL applications and position, proximity and speed sensors; the selection criteria for field instruments, instrument certification and documentation, final elements in SIF design and final element reliability and testing; the logic solvers of PLCs and safety controllers, interface between instruments and logic solvers, digital communication in SIS and the integration of instruments with asset management; the SIL verification calculations, proof testing of SIL instruments, functional safety management (FSM) and auditing and functional safety assessments.

Course Objectives

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

- Apply and gain an in-depth knowledge on SIL/SCE instruments selection
- Discuss functional safety, safety instrumented functions (SIF) and SIS, safety integrity levels (SIL) and safety critical elements (SCEs)
- Explain IEC 61508 and IEC 61511 standards, regulatory and industry context, hazard and risk assessment (H&RA), layers of protection analysis (LOPA) and safety requirements specification (SRS)
- Determine SIF demand mode and architecture and explain the functional safety assessment (FSA) and interfaces with BPCS and other systems
- Identify the general considerations in instrument selection, pressure, level, temperature instruments, flow instruments for SIL applications and position, proximity and speed sensors
- Determine the selection criteria for field instruments, instrument certification and documentation, final elements in SIF design and final element reliability and testing
- Analyze logic solvers of PLCs and safety controllers, interface between instruments and logic solvers, digital communication in SIS and the integration of instruments with asset management
- Discuss SIL verification calculations, proof testing of SIL instruments, functional safety management (FSM) and auditing and functional safety assessments

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/SCE instruments selection for instrumentation engineers, control system engineers, safety engineers, process engineers, automation engineers, electrical engineers (involved in SIS design), project engineers (involved in feed or EPC stages), maintenance engineers (responsible for SIS and SCE), engineering consultants, system integrators, HAZOP/LOPA facilitators, technical safety engineers, operations engineers (familiar with plant critical safety systems), instrumentation technicians (with advanced roles) and other technical staff.

Accommodation

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

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: -

- 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.

- 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.

Course Fee
US$ 6,000 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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 **30 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 and Control**, **Mass Measuring System Batching** (**Philips**), Arc Furnace Automation-Ferro Alloys, Walking Beam Furnace, Blast Furnace, Billet Casting Station, Cement Kiln Automation, Factory Automation and Quality Assurance Accreditation (**ISO 9000** and **Standard BS 5750**). 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

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.

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:	***Sunday, 08th of September 2025***
0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of Functional Safety*** *What is Functional Safety? • Relationship with Process Safety & Asset Integrity • Safety Lifecycle Overview (IEC 61508 / IEC 61511) • Basic Terminology: SIF, SIS, SRS*
0930 – 0945	*Break*
0945 – 1030	***Safety Instrumented Functions (SIF) & SIS*** *Definition & Role of SIFs • SIS Architecture & Components (Sensor, Logic Solver, Final Element) • Differences Between Basic Process Control System (BPCS) & SIS • Independent Protection Layers (IPLs) & LOPA Relationship*
1030 – 1130	***Safety Integrity Levels (SIL) Explained*** *SIL 1–4: Definitions & Targets • Probability of Failure on Demand (PFDavg) • Risk Reduction Factor (RRF) • Quantitative versus Qualitative SIL Methods*
1130 – 1215	***Safety Critical Elements (SCEs) Overview*** *Definition of SCEs in Safety Case Regime • Examples in Offshore/Onshore Processing • Integrity Management of SCEs • Relationship to SIF Instruments*
1215 – 1230	*Break*
1230 – 1330	***IEC 61508 & IEC 61511 Standards*** *Scope & Structure of Each Standard • Differences Between Equipment & Application Standards • Compliance & Certification Requirements • SIL Determination & Verification Workflows*
1330 – 1420	***Regulatory & Industry Context*** *Compliance in High Hazard Industries • Role of Regulatory Bodies (HSE, OSHA, API RP 14C, etc.) • Case Study of Failures Due to Poor SIL Compliance • Corporate Governance & FS Management*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: **Monday, 09th of September 2025**

0730 – 0830	***Hazard & Risk Assessment (H&RA)*** *HAZOP Integration with SIL • Risk Graph, Risk Matrix & LOPA • Identifying Causes, Consequences & Safeguards • When to Assign a SIF*
0830 – 0930	***Layers of Protection Analysis (LOPA)*** *Initiating Event Frequency • Enabling Conditions & Independent Layers • SIF Necessity & Target SIL • Common LOPA Tools & Templates*
0930 – 0945	*Break*
0945 – 1100	***Safety Requirements Specification (SRS)*** *Key Contents of SRS for SIFs • Functional & Safety Integrity Requirements • Environmental, Diagnostic & Response Time Specs • Writing Clear & Auditable SRS Documents*
1100 – 1215	***Determining SIF Demand Mode & Architecture*** *Low versus High Demand Mode • 1oo1, 1oo2, 2oo3 Architectures Explained • Redundancy & Fault Tolerance • Benefits & Drawbacks of Architectures*
1215 – 1230	*Break*
1230 – 1330	***Functional Safety Assessment (FSA) Phases*** *FSA Stages 1 to 5 • Objectives & Timing Across Lifecycle • Role of Independence & Evidence Gathering • Documentation & Closure Requirements*
1330 – 1420	***Interfaces with BPCS & Other Systems*** *Safe Separation of BPCS & SIS • Communication Between SIS & SCADA/DCS • Cybersecurity for SIS Components • Alarms versus Trips: Functional Separation*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3: **Tuesday, 10th of September 2025**

0730 – 0830	***General Considerations in Instrument Selection*** *Safety versus Operational Instruments • Certified versus Proven-In-Use Instruments • Environmental, Process & Installation Conditions • Accuracy, Response Time, Repeatability Requirements*
0830 – 0930	***Pressure, Level, Temperature Instruments*** *SIL-Certified Pressure Transmitters (dP, Gauge, Absolute) • SIL-Rated Level Devices (Radar, Ultrasonic, Guided Wave) • Temperature Elements (RTD, Thermocouple) & Transmitters • Common Failure Modes & Suitability*
0930 – 0945	*Break*
0945 – 1100	***Flow Instruments for SIL Applications*** *Magnetic, Ultrasonic, Coriolis, Vortex & Orifice Types • Criteria for SIF Suitability • Installation Conditions & Failure Risks • Redundancy in Flow Measurements*
1100 – 1215	***Position, Proximity & Speed Sensors*** *Use in Valve Position Feedback & Rotating Machinery • Limit Switches, Proximity Sensors (Inductive, Capacitive) • Mechanical versus Electronic Reliability • SIL Rating & Testing Intervals*
1215 – 1230	*Break*
1230 – 1330	***Selection Criteria for Field Instruments*** *Safe Failure Fraction (SFF) • Diagnostic Coverage (DC) & Proof Test Interval (PTI) • Failure Modes Effects & Diagnostic Analysis (FMEDA) Reports • Functional Safety Certification versus Site Qualification*

1330 – 1420	***Instrument Certification & Documentation*** *TÜV Rheinland, Exida & Other Certifying Bodies • SIL Certificates & Safety Manuals • Use of Failure Rate Data from OREDA, NAMUR NE 95 • Manufacturer Documentation Review*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4: Wednesday, 11th of September 2025

0730 – 0830	***Final Elements in SIF Design*** *Control Valves, Solenoid Valves, Actuators • ESDVs & Blowdown Valves • Pneumatic versus Electric Actuation • Spring Return & Fail-Safe Modes*
0830 – 0930	***Final Element Reliability & Testing*** *Partial Stroke Testing (PST) • Solenoid Valve Failure Modes • Common Cause Failure in Final Element Loops • Proof Testing of Valve Assemblies*
0930 – 0945	*Break*
0945 – 1100	***Logic Solvers of PLCs & Safety Controllers*** *Safety PLC versus Standard PLC • Dual-Processor, Lock-Step Architecture • Response Time & Diagnostic Coverage • Certified Logic Solvers (e.g., Triconex, HIMatrix)*
1100 – 1215	***Interface Between Instruments & Logic Solvers*** *4–20 mA Analog Signals versus Digital Protocols • Use of Safety-Rated Barriers & Isolators • Input/Output Diagnostics & Filtering • Redundancy & Hot-Swappable Cards*
1215 – 1230	*Break*
1230 – 1330	***Digital Communication in SIS*** *HART Pass-Through & Safety Implications • PROFIsafe, EtherNet/IP & Other Safety Protocols • Wireless Instrumentation Considerations • Managing Latency & Signal Integrity*
1330 – 1420	***Integration of Instruments with Asset Management*** *Online Diagnostics & Condition Monitoring • Predictive Maintenance for SCEs • Integration with CMMS & Safety Lifecycle Tools • Alarm Management & Event Logging*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

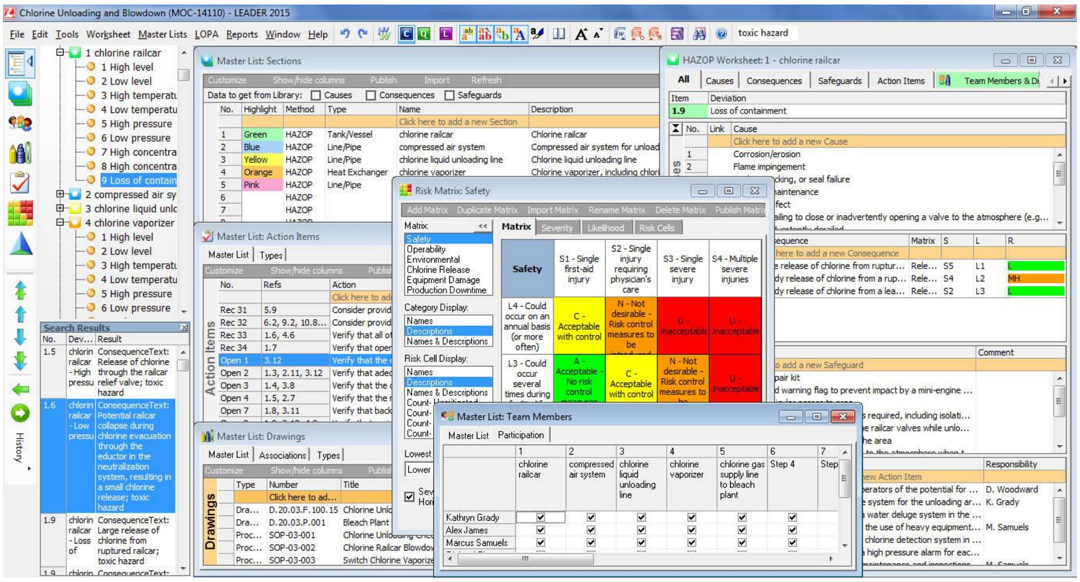
Day 5: Thursday, 12h of September 2025

0730 – 0830	***SIL Verification Calculations*** *Probability of Failure on Demand (PFDavg) • Calculation Tools (e.g., ExSILentia, SILcet, OrbitSIL) • Input Data (SFF, ADU, Test Intervals) • Examples of Sensor-Loop-Final Element Verification*
0830 – 0930	***Proof Testing of SIL Instruments*** *Proof Test versus Calibration • Test Intervals & Test Coverage • Test Procedures & Documentation • Impact on PFDavg & Lifecycle Compliance*
0930 – 0945	*Break*

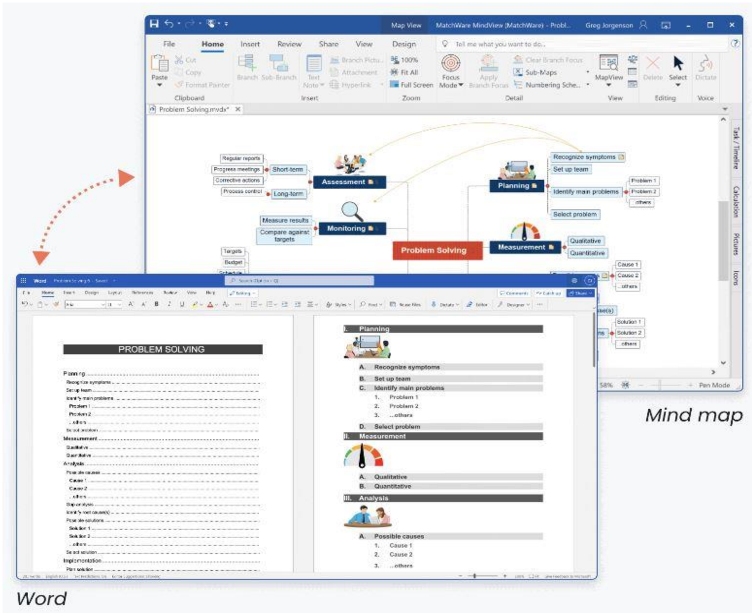
0945 – 1030	***Functional Safety Management (FSM)*** *Lifecycle Phases: Planning, Design, Operation, Decommissioning • Management of Change (MoC) for SIFs & SCEs • Roles & Competency of Responsible Personnel • Record Keeping & Audit Trails*
1030 – 1130	***Auditing & Functional Safety Assessments*** *Internal versus External FSA Process • Audit Checklists for SIL Instruments • Common Gaps & Remediation Actions • SIL Compliance in Brownfield Upgrades*
1130 – 1230	***Case Studies & Practical Exercises*** *Instrument Failure Leading to SIF Malfunction • Success Story: Cost-Effective SIS Upgrade • SIL Selection for HIPPS, ESD, PSD Systems • Group Exercise: Select Instruments for a SIL2 Loop*
1230 – 1245	*Break*
1245 – 1345	***Course Review, Final Assessment & Certification*** *Summary of Key Learning Points • Quiz or Group-Based SIL Review • Participant Feedback & Q&A • Certificate Distribution & Closing Remarks*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

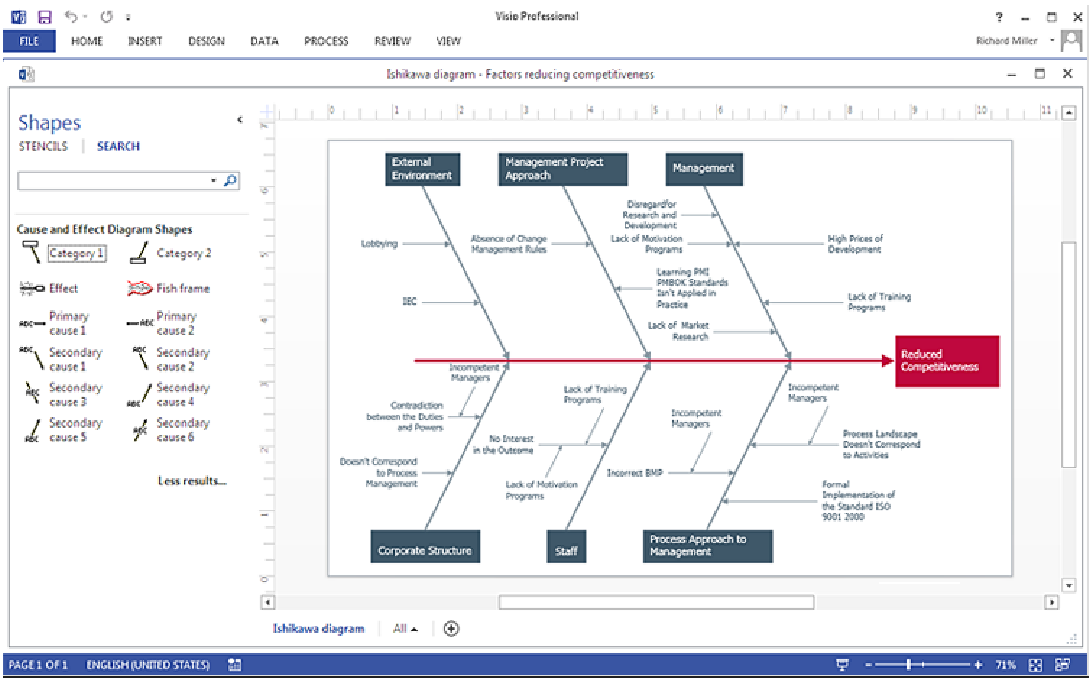
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using our state-of-the-art “PHA/HAZOP”, “Mindview Software”, “Visio Software” and “Safety Automation Builder Software (Rockwell Automation)” simulators.



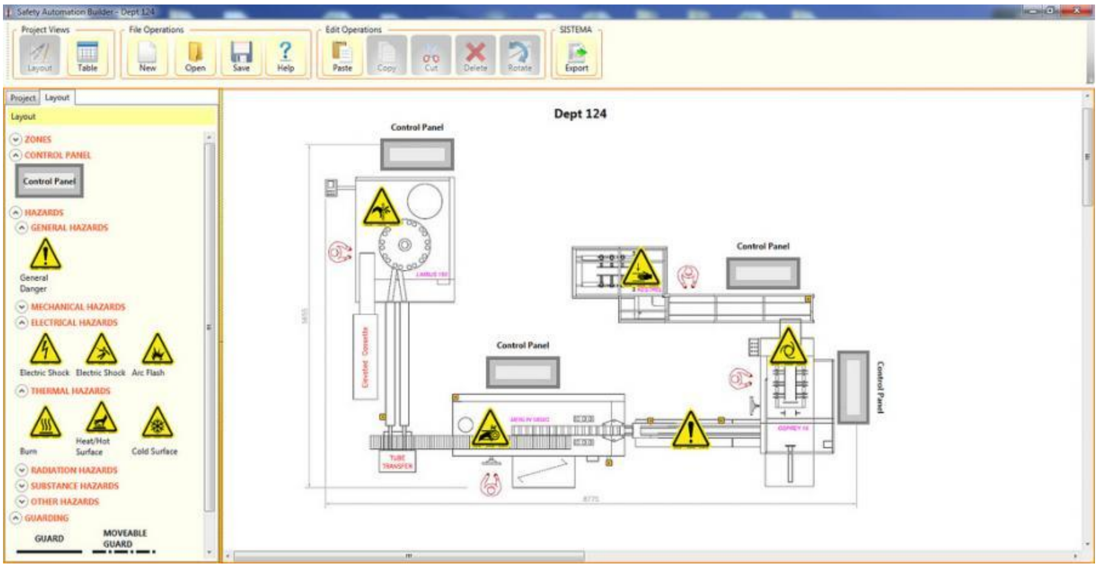
PHA/HAZOP Simulator



Mindview Software



Visio Software



Safety Automation Builder (Rockwell Automation) Software

Course Coordinator

Reem Dergham, Tel: +974 4423 1327, Email: reem@haward.org