Making safety second nature.
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The Mary Kay O’Connor Process Safety Center was established in 1995 as part of the Texas A&M Engineering Experiment Station (TEES) in memory of Mary Kay O’Connor, an operations superintendent who died in an explosion 23 October 1989 at a petrochemical complex in Pasadena, Texas, USA. Mary Kay O’Connor graduated from the University of Missouri with a degree in chemical engineering and received an MBA from the University of Houston-Clear Lake. In 1997, Dr. Sam Mannan was appointed director of the center because of his reputation as a world-renowned expert in process safety.

The center’s mission is to promote safety as second nature in industry around the world with goals to prevent future accidents. In addition, the center develops safer processes, equipment, procedures and management strategies to minimize losses within the processing industry. However, the center realizes that it is necessary to advance process safety technologies in order to keep the industry competitive. Other functions of the center include that it serves all stakeholders, provides a common forum, and develops programs and activities that will forever change the paradigm of process safety. The funding for the center comes from a combination of the endowment, consortium funding and contract projects.

On 1 July 2013, Qatar Petroleum and Texas A&M University at Qatar officially launched the MKOPSC extension in Qatar. The extension works to replicate all academic programs and activities of the center at Texas A&M’s main campus in College Station, Texas, USA. The center has the honor to be under the patronage of His Excellency Dr. Mohammed Bin Saleh Al-Sada, Minister of Energy and Industry, Chairman and Managing Director of Qatar Petroleum, who played a central role in the establishment of the center in Doha.
The MKOPSC extension in Qatar is currently supported by a consortium of industries that forms the Steering Committee. The Steering Committee, supported by the Technical Advisory Committee, meets to define the direction of the center to ensure that the research endeavors are of high importance and relevance for the local industry in Qatar.

Mission
Lead the integration of process safety — through education, research and service — into learning and practice of all individuals and organizations.

Vision
◊ Serve as the Process Safety Center of Excellence that promotes:
◊ Process safety as a personal value that is second nature for all stakeholders.
◊ Continuous progress toward zero injuries and elimination of adverse impacts on the community.

Values
◊ Health and safety of the community and the workforce.
◊ Sharing of knowledge and information.
◊ Sound scholarship and academic freedom.
◊ Diversity of thought and viewpoint.
◊ Independence to practice sound science.
◊ Integrity of science validated by peer review.
◊ Opportunity to provide input on public policy issues.
◊ Progress without undue influence by special interests.
◊ Individual and group achievement.
MKOPSC is supported by a consortium of 10 companies:

ConocoPhillips
ExxonMobil Research Qatar (EMRQ)
Occidental Petroleum Qatar (OXY)
Qatar Chemical Company (QChem)
Qatargas
Qatar Fuel Additive Company (QAFAC)
Qatar Petroleum
Rasgas
Qatar Shell
QAPCO
Instructors include leaders in the fields of process safety management; liquefied gas safety; ammonia and fertilizer plant safety; refinery and chemical plant safety engineering; laboratory safety; and risk assessment for the process industries.

Customized Courses
MKOPSC also provides structured training programs aimed at specific company objectives. Any of our short courses can be tailored to the specific needs of the facility if desired. Having the instructor travel to your facility eliminates travel time and costs for the facility employees. This option presents a win-win for you and your employees — no travel, a tailored course and a focused group of colleagues with similar experience and objectives. These courses can accommodate audiences as small as eight or up to 25, in general.

For more information please contact Deena Fernandes at +974.4423.0590 or Dr. Luc Vechot at +974 44230108, or by email at mkopsc@qatar.tamu.edu.
## Symposia
The following events hosted every year by the center are eligible for continuing education credit and offer a variety of training and educational opportunities:

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<td>Qatar Process Safety Symposium(^1)</td>
<td>Spring</td>
<td>Doha, Qatar</td>
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<td>MKOPSC International Symposium(^2)</td>
<td>Fall</td>
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<tr>
<td>Annual Instrumentation and Automation Symposium for the Process Industries(^3)</td>
<td>Spring</td>
<td>College Station, Texas, USA</td>
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\(^1\)http://qpss.qatar.tamu.edu/  
\(^2\)http://psc.tamu.edu/symposia  
\(^3\)http://instrumentation-symposium.che.tamu.edu/
The Safety Practice Certificate Program allows engineers currently in industry to gain a greater knowledge of process safety. This program was created for those industry engineers who want a more in-depth study of process safety in chemical engineering. The certificate requires 125 PDHs for completion within a three-year time frame. It has 84 PDHs of required courses. The remaining hours may be obtained through courses offered at Texas A&M at Qatar, other distance learning course offerings, and through the center’s symposia. There is some flexibility in choice of topic with the continuing education classes to allow specialization in a given area.

The application for this certificate is always open. The application for the program and a worksheet to help you keep track of the credits you have earned are available at http://psc.tamu.edu/education/process-safety-practice. Upon completion of the program requirements, participants will be issued a certificate of completion.
Continuing Education Units (CEUs)/
Professional Development Hours (PDHs)

The CEU is a nationally recognized unit designed to provide a record of an individual’s continuing education achievements. The Texas A&M Engineering Program Office of Continuing Education, in cooperation with TEES, has approved the MKOPSC short courses for CEUs. As per the Texas Board of Professional Engineers:

Each license holder shall meet the Continuing Education Program (CEP) requirements for professional development as a condition for license renewal. Every license holder is required to obtain 15 PDH units (1.5 CEUs) during the renewal period year. A minimum of 1 PDH (0.1 CEU) per renewal period must be in the area of professional ethics, roles and responsibilities of professional engineering, or review of the Texas Engineering Practice Act and Board Rules. The complete rule can be found on the Texas Board of Professional Engineers website at RULE § 137.17 Continuing Education Programs.

A CEU certificate will be issued by the Texas A&M Engineering Program Office of Continuing Education upon the successful completion of each course.
The following provides a detailed description of the continuing education courses provided by MKOPSC-Qatar.

**FUNDAMENTALS OF PROCESS SAFETY AND LOSS PREVENTION**

**Course Number:** 4015Q  
**Duration:** 5 days

**Description:**
This short course is designed to teach and apply the fundamentals of chemical process safety. The content is comprehensive and provides extensive analysis, worked-out examples and case histories. The primary emphasis of this course is to summarize the important technical fundamentals of chemical process safety. The emphasis on fundamentals helps the practicing engineer understand the concepts and apply them accordingly.

The course starts with a brief overview of the management systems that must be in place in a modern plant in order to implement process safety. Appropriate discussion and problems solving time is provided for each of the areas of toxicology and industrial hygiene, hazard identification, consequence analysis, quantitative risk assessment, and risk-reduction measures. The course also introduces two important concepts that are often overlooked — inherently safer design and multiple barriers of protection.

**Who should attend?**
This course is intended for those who are working in the process industry and would like to obtain a comprehensive overview of the fundamentals of chemical process safety and loss prevention. Attendees are likely to have degrees in engineering or science, or equivalent industrial experience.
Organization of the courses

To optimize the quality of each course and encourage discussion during the class, the number of delegates is normally restricted to a maximum of 25.

When appropriate a visit to the MKOPSC process safety laboratory at Texas A&M at Qatar will be organized.

For all the continuing education courses, the attendee will receive:
- a course manual in the form of a hard copy of the handouts;
- a soft copy of the handouts on a USB key; and
- a certificate to those who successfully complete the course.

Registration

To register online go to: http://www.qatar.tamu.edu/academics/continuing-education/

When on the Schedule of Classes and Registration page, select from the list of courses offered and choose Register for this course. You will be linked to a secure site allowing you to register and pay for the course online. You will receive a confirmation email upon completing your registration.

For all other questions contact:
For more information please contact Deena Fernandes at +974.4423.0590 or by email at mkopsc@qatar.tamu.edu.
Description
This short course is designed to teach and apply the fundamentals of chemical process safety. The content is comprehensive and provides extensive analysis, worked-out examples and case histories. The primary emphasis of this course is to summarize the important technical fundamentals of chemical process safety. The emphasis on fundamentals helps the practicing engineer understand the concepts and apply them accordingly.

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Who should attend?
This course is intended for those who are working in the process industry and would like to obtain a comprehensive overview of the fundamentals of chemical process safety and loss preventions. Attendees are likely to have degrees in engineering or science, or equivalent industrial experience.
Course instructors

Dr. Luc Véchot, Dr. Tomasz Olewski, Dr. Konstantinos Kakoimos, Dr. Ioannis Economou, Dr. Marcelo Castier, Dr. Walid Khalbouei and Nasser Al Jassem (MKOPSC-Qatar)
Michael J. Snakard (Snakard Consulting Group LLC)

Agenda

Day 1: Why and How to Manage Process Safety?
◊ Process safety management systems.
◊ Incident investigation.
◊ Process safety metrics.

Day 2: Hazard Identification
◊ Hazardous phenomena (toxic hazards, fundamentals of fire and explosion, chemical reaction hazards, corrosion).
◊ Hazard identification techniques.
◊ Hazard identification workshop.

Day 3: Risk Analysis
◊ Principles of quantitative risk assessments.
◊ Probabilistic calculations.
◊ Consequence modeling.
◊ Layers of protection analysis (LOPA).

Day 4: Controlling the Risks
◊ Inherently safer design concepts.
◊ Fire and explosion protection and prevention.
◊ Application of safety instrumented systems.
◊ Pressure relief and disposal systems.
◊ Plant layout and equipment spacing.

Day 5: Risk Assessment and Presentation
◊ Risk criteria.
◊ Quantitative risk assessment workshop.
◊ Demo of consequence modeling software.
This short course is designed to teach and apply the fundamentals of chemical process safety; to provide a basic understanding of process safety and the requirements of OSHA PSM Regulation 29 CFR 1910.119 and EPA Risk Management Plan 40 CFR Part 68; to understand through case studies how the failure of process safety management elements were found to be the root cause of major incidents in the petroleum industry; to provide information on how to implement, monitor and audit a process safety management program; and to illustrate through exercises the identification of hazards and the ranking of risks.

Who should attend?
The course content is diverse enough for use by anyone involved in improving process safety, including chemical engineers, mechanical engineers, safety and health personnel, industrial hygiene personnel and operators, and maintenance supervisors.
Course instructor
Dr. Ray Mentzer (MKOPSC)

Agenda
Module 1: Introduction to Process Safety Management (PSM)
◊ Introduction.
◊ History of process safety legislation in the U.S. illustrated through past events.
◊ What is process safety?
◊ Process safety concepts and overview of the PSM elements.

Module 2: Description of Each PSM Element and Case Studies
◊ Documentation.
◊ Employee participation.
◊ Accountability and leadership.
◊ Process safety information.
◊ Process hazard analysis.
◊ Mechanical integrity (case study: “Humber Refinery — Catastrophic Failure of De-ethanizer Overhead Pipe”).
◊ Safe work practices (hot work case study: “Piper Alpha Disaster”).
◊ Contractor management.
◊ Operating procedures (case study: “Feyzin LPG Disaster”).
◊ Training and competence.
◊ Management of change (case study: “Flixborough Disaster”)
◊ Pre-startup safety review.
◊ Emergency planning and response (case study: “Major Tank Fire”).
◊ Incident investigation.
◊ Process safety audit.
◊ Trade secrets.
Hazard and operability (HAZOP) studies can be one of the most powerful tools your facility has for identifying process hazards within the operating facility. Do you understand your role in the HAZOP process? Are you contributing to your fullest extent?

This course will provide an understanding of why we do HAZOP, the objectives of a HAZOP review, what is expected from a participant in a HAZOP and how to be an active participant in the HAZOP process. In addition, the course will also teach participants how to read a HAZOP report and what the HAZOP report can teach us about the process hazards and safety systems in place to minimize the risk of catastrophic events.

The course will provide a brief overview of the role of HAZOP in process safety management and risk assessment process and will go into detail on HAZOP terminology, guidewords and the HAZOP process.

Who should attend?
The class is intended to be an introductory course for technical and operating staff who regularly attend HAZOP reviews or who expect to and/or plan to attend HAZOP reviews in the future. In addition, this class will also benefit operations staff as it will provide valuable instruction on how to read HAZOP reports and use the information within a HAZOP report to improve the safe operation of their process plants.

Course Number: 2032Q  Duration: 2 days

Description
Hazard and operability (HAZOP) studies can be one of the most powerful tools your facility has for identifying process hazards within the operating facility. Do you understand your role in the HAZOP process? Are you contributing to your fullest extent?

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Course instructor
Michael J. Snakard (Snakard Consulting Group LLC)

Agenda

Day 1: Fundamentals of HAZOP methodology
◊ Introduction.
◊ Hazards and risks.
◊ Elements of process safety management.
◊ Process hazard analysis.
◊ The HAZOP process.
◊ HAZOP worksheet.
◊ HAZOP terminology.

Day 2: Toward an Active Participation in HAZOP
◊ What does “being an active participant” mean?
◊ Case studies: How could HAZOP have prevented accidents?
◊ Mock HAZOP on a compressor process facility.
  ○ Participant will:
    ◦ Focus on the node and deviation under study.
    ◦ Identify credible causes and consequences
    ◦ Locate existing safeguards.
    ◦ Determine when recommendations are needed.
◊ What happens after HAZOP?
◊ Reading a HAZOP report.
◊ Conclusion.
Are you looking to transform the quality of your hazard and operability (HAZOP) studies? Do you want to do more than just comply with the standard or do more than just continually improve? Are you looking to make a step function change in the analysis of process hazards within your plant?

This five-day course will transform the way you lead HAZOP reviews. The class goes beyond traditional HAZOP courses and challenges facilitators to embrace their role in the future possibility of zero process safety accidents. In addition to providing attendees with detailed instruction on the need for HAZOPs, the objective of HAZOP, the HAZOP process and the application of guidewords to lead a HAZOP team through the successful completion of a HAZOP review, the class will introduce the concept of demanding more from the HAZOP team, leading them to uncover “what they didn’t know they didn’t know.”

The course will also provide a brief overview of the role of HAZOP in process safety management and risk assessment, and will discuss the use of other hazard-identification processes, highlighting similarities and differences with the HAZOP process.

Who should attend?
The class is intended to be a HAZOP facilitation course for experienced professionals who already have a good understanding of process safety management, who have participated in HAZOP reviews, and who either want to become a great facilitator or want to make a more meaningful contribution to the HAZOP reviews they attend. While not mandatory, it is recommended that attendees take the process safety management course or HAZOP refresher course offered by the center prior to this class.
Course instructor
Michael J. Snakard (Snakard Consulting Group LLC)

Agenda
Day 1: Introduction to HAZOP
◊ The objectives of the HAZOP technique.
◊ HAZOP terminology and definitions.
◊ The HAZOP process (preparing, facilitating and reporting).

Day 2: Transforming your HAZOPs
◊ Qualities of a great HAZOP facilitator.
◊ Bringing process safety culture to your HAZOP study.
◊ Uncovering what the team didn’t know they didn’t know.
◊ In-class practical exercise: HAZOP Documentation.

Day 3: International Best Practices
◊ Special considerations (batch processes, global issues, revalidation).
◊ HAZOP LOPA, HAZOP SIL.
◊ Living into the future possibility of ZERO accidents.
◊ Group exercise: Participating in a Great HAZOP.

Day 4: Practical Guide to Getting Started
◊ Process safety information.
◊ Estimating the duration of the HAZOP.
◊ In-class exercise: Identifying HAZOP Nodes.
◊ Starting a HAZOP review (scope methodology and process).
◊ Managing the flow of the HAZOP.
◊ HAZOP revalidations.
◊ RAGAGEP (recognized and generally accepted good engineering practice).
◊ In-class exercise: Putting it all Together.

Day 5: Group Exercise — Leading a Great HAZOP
◊ Break out into groups of 5-6 people per group.
◊ Alternate facilitating a great HAZOP.
◊ Constructive feedback from the group and instructor.
◊ Group discussion.
◊ Questions and answers.
Description
This introductory course looks at the principles and practices of quantitative risk assessment. Hazard identification and quantitative risk assessment (QRA) are key elements of a process safety management system. This course, suited to those starting their careers in process safety, will start with a review of the existing legal requirements for risk assessments in U.S. and EU countries, an overview of some of the most common process hazards and hazards identification techniques, with particular attention to the principle features of effective quantitative risk assessment. This includes an in-depth analysis of the risk estimation and evaluation techniques as well as the implementation of risk reduction measures.

Who should attend?
This course is introductory and intended for those who are starting a career in process safety management. Delegates are likely to have a degree in engineering or science or equivalent industrial experience. Experience of working in the process industries will be an advantage.
Course instructors
Dr. Luc Véchot (MKOPSC-Qatar)
Dr. Tomasz Olewski (MKOPSC-Qatar)

Agenda
Day 1: Methods and Techniques for the Evaluation of Risks
◊ Introduction.
◊ Regulatory framework.
◊ Definitions and concepts (hazards, risks).
◊ Main components of a quantitative risk assessment (QRA).
◊ Overview of the main process hazards.
◊ Hazards identification techniques.
◊ Consequence analysis (including software demo).
◊ Probabilistic calculations.

Day 2: Practice of Risk Assessment
◊ Risk assessment principles.
◊ Risk tolerability criteria.
  ○ Risk matrix.
  ○ ALARP.
  ○ Individual and societal risks.
◊ Individual risk calculation workshop.
◊ Societal risk calculation workshop.
◊ Risk reduction measures.
Description

Area classification is an important topic at this time because it is essential to meet OSHA Process Safety Management (PSM) requirements as indicated in 29 CFR 1910.119. It is more important because of safety, National Electric Code (NEC) compliance, and economic reasons. The engineering spent on classification has a fast payout. In this era of global competition, companies cannot financially or legally afford to shortchange classification. Recent additions to the 1996 NEC emphasize the importance of area classification drawings.

This course provides a comprehensive comparison of the types of area classification for chemical and petroleum processes and highlights the differences and, in particular, the application variations of NFPA 497A and API RP500. The complexities in applying these standards will be discussed. Finally, the course also presents a technique that meets OSHA process safety management requirements and has other significant advantages. In addition, in Europe the ATEX directives require stringent attention to area classification. The purpose of this course is to share ideas on classification and to present and discuss examples of classification drawings that will be useful to those involved in this important task.
Who should attend?
This course is intended for those people who are involved in determining and implementing area classification plans, operations and maintenance personnel required to comply with area classification policies and procedures, PSM coordinators, and PSM auditors.

Course instructor
Jack Chosnek (consultant in process safety management and knowledge management)
The emphasis of this course is the technical understanding of combustible dust phenomena. It enables attendees to better understand dust hazards, to recognize potentially serious events, and to implement effective safeguards. The course will prove helpful to experienced engineers, safety supervisors, and operating managers who are committed to safe workplaces. The course will provide a unique opportunity to attend a dust explosion demonstration in MKOPSC-Qatar Process Safety Laboratory.

Who should attend?
PSM managers, HSE managers, engineers and operations personnel employed by industries where the presence of hazard zones created by dust is very likely.
Course instructor
Dr. Simon Waldram (Waldram Consultants Ltd)

Agenda
◊ Understanding fundamental concepts.
◊ Learning from well-documented dust explosions.
◊ Recognizing factors that influence severity of an event.
◊ Surveying effective risk recognition and hazard mitigation techniques.
◊ Comprehensive overview of codes and standards, recognized and generally applied good engineering practices, OSHA regulations and OSHA’s National Emphasis Program.
◊ Visit to the MKOPSC Process Safety Laboratory for a combustible dust explosion demonstration.
Description
Layers of Protection Analysis (LOPA) is a popular risk analysis technique. It is conducted after a process hazards analysis has identified hazardous events needing further analysis to better understand the functional and risk reduction requirements for the safeguards. This course discusses the quantitative assessment of initiating event frequencies and the robustness of safeguards.

The course stresses understanding of event propagation, the attributes required for safeguards to be qualified as independent protection layers (IPL), and the proper determination of hazardous event frequencies. Evaluating enabling conditions and the appropriate use of frequency modifiers in PHA and LOPA are discussed, as well as the interrelationship of risk criteria and analysis boundaries. The course addresses how to document risk gaps in LOPA recommendations, including using LOPA to assign the target safety integrity level (SIL) to identified safety instrumented systems (SIS). Workshop examples are used to illustrate the methodology and emphasize key learning points.

Who should attend?
Process safety managers, process safety specialists, process engineers, operations personnel, instrumentation and electrical personnel, LOPA facilitation trainees, LOPA facilitators, and PHA facilitators.
Course instructor
Bill Hearn (TÜV functional safety expert)

Agenda
Day 1:
- Risk management.
  - Process risk measurements.
  - PHA workshop.
- Risk criteria.
  - Hazardous and harmful events.
  - Enabling conditions and conditional modifiers.
  - LOPA criteria.
  - Frequency workshop.
- Independent protection layers (IPL).
  - Types.
  - Assessing independence.
  - Independence workshop.
- Core attributes.
  - Core attributes workshop.

Day 2:
- LOPA methodology.
  - Initiating cause frequency.
  - IPL risk reduction.
  - Independence of control and instrumented safety functions.
  - LOPA IPL workshop.
- IPLs and side effects.
  - Understanding secondary consequences.
  - Multiple LOPA workshop examples.
LABORATORY SAFETY COURSE

Course Number: 2092Q  Duration: 2 days

Description
MKOPSC-Qatar presents a two-day course on laboratory safety. This course provides an overview of the fundamentals of safety management in a laboratory.

The first part of the course will raise awareness on the common chemical and physical hazards associated with the work in chemical engineering and chemistry laboratories. The attendees will learn about hazard communication, safe work practices, hierarchy of risk control strategies from inherent safety to personal protective equipment and emergency preparedness. The teaching will be supported by several historical case studies, demonstrations and videos. The second part of the course will teach the attendees write an effective risk assessment for their work in the laboratory through a series of interactive in-class workshops where the students will have to identify the hazards associated to an experimental setup, identify the protection and mitigation barriers, semi-quantitatively evaluate the risks associated to the setup, and propose risk reduction measures.

The course will help the attendees to affirm or reaffirm their commitment to excellence in safety.

A visit to a laboratory is scheduled at the end of the session.

Who should attend?
This course is intended for those who are involved in chemical engineering and chemistry laboratories work, including laboratory technicians, laboratory managers, laboratory safety coordinators and researchers.
Course instructors

Dr. Luc Véchot and Dr. Tomasz Olewski (MKOPSC-Qatar)
David Onchagwa and Khaled Elsaid (Texas A&M at Qatar)

Agenda

Day 1: Hazards and Risks in Laboratories

◊ Introduction.
◊ Incident case stories and safety culture.
◊ Hazard communication: hazard symbols (NFPA, EU, GHS).
◊ Workshop on how to read a safety data sheet.
◊ Laboratory hazard awareness: chemical and physical hazards.
◊ General laboratory safe practices.
  ○ Chemical hygiene.
  ○ Chemical management from cradle to grave.
  ○ Safe use of electrical and mechanical equipment.
◊ Hierarchy of risk control strategies (from inherent safety to PPE).
◊ Emergency preparedness.

Day 2: Risks Assessment in Laboratories.

◊ Fundamentals of laboratory safety management systems.
◊ Principles of semi-quantitative risk assessment.
  ○ Elements of a semi-quantitative risk assessment.
  ○ Hazard identification techniques.
  ○ Determination of incident likelihood.
  ○ Risk matrix and risk reduction measures.
◊ Practice: risk assessment workshops⁴:
  ○ Workshop 1: laboratory gas blending setup experiment.
  ○ Workshop 2: experimental study of chemical reactivity using adiabatic calorimeter.
◊ Visit of the process safety laboratory.

⁴Note: The examples treated in class can be adapted to fit the needs of attendees.
Course Number: 2101Q  Duration: 1 day

Description
OSHA’s process safety management standard has identified management of change (MOC) as a key element in controlling the potential hazards in a chemical processing facility. MOC policies and procedures are designed to insure that changes within chemical process plants do not result in operations outside established safety parameters.

The purpose of this course is to explain the concepts and current practice of MOC and to present a methodology designed to develop, implement and maintain an ongoing MOC program based on proven engineering management practices and regulatory requirements. In addition to examples of existing MOC policies and lessons learned from related industries, the course will provide sample MOC program outlines and checklists to assist participants in implementing an effective MOC program at their respective facilities.

Upon completion of this course, participants should be able to develop a customized version of the MOC policies and procedures provided herein. Furthermore, participants shall also

Who should attend?
This course is designed for corporate safety officers, chemical process design engineers, technical managers, and plant-level chemical manufacturing management.
Course instructor
Jack Chosnek (consultant in process safety management and knowledge management)

Agenda
◊ Concepts.
◊ Definitions.
◊ Principals and examples.
◊ Management of change practice.
◊ Interface to process safety management program.
◊ Auditing management of change.
◊ Risk management process requirements.
◊ Screening risk ranking techniques.
◊ Review example procedures.
Description
This course is designed to provide an overview of the process safety management to managers. The content is comprehensive and provides case histories of the implementation of safety programs at diverse facilities — both big and small, and involved in diverse operations. Emphasis is placed on how process safety programs interact with the overall operations in the facility and what managers can do to minimize risk, but at the same time, keep the company running productively.

This course is designed to give managers an overall understanding of process safety programs so that they can efficiently budget for and allocate resources for the program and manage the process safety personnel. Exercises and workshops are used throughout the course to illustrate interpretations of the requirements and demonstrate ways to develop an effective safety management programs.

Who should attend?
This course is suitable for managers starting from front-line supervision to executive officers, board of directors and CEOs. This course provides a high-level organizational perspective of the prevention and compliance requirements for safety management and relates everything to company exposure, risk and sustainability.
Course instructor
Dr. Ray Mentzer (MKOPSC)

Agenda
Module 1: Role of the Leader/Manager
◊ Scope of process safety and relation to personnel safety.
◊ Impact of leadership on process safety in the organization and its processes.
◊ Recognition of employee perception of leadership commitment to safety.
◊ Quality and style of leadership.
◊ Education of senior leaders in the particular case of process safety.
◊ Business case for effective process safety management.

Module 2: Hazards and Risks
◊ Features of a strong organizational safety culture.
◊ Metrics for monitoring process safety performance.

Module 3: Elements of PSM Systems and Assurance of Effectiveness
◊ Comprehensive process safety management systems.
◊ Effectiveness of PSM systems and competencies.
◊ Relationship between business decisions and process safety outcomes.
◊ Assurance processes for effective risk management.
◊ Human factors.

Module 4: Normalization of Deviation and Lessons Learned from the Past
◊ Learnings from case studies to prevent incidents.
◊ Framework for creating a best-in-class safety culture — 10 attributes.
Description
This course reviews the various good engineering practices that apply to safety instrumented systems (SIS) implemented in process industry facilities. It presents the requirements of IEC 61511 using a lifecycle framework that is supplemented with several industrial guidance documents. It explains how risk analysis techniques, such as layer of protection analysis (LOPA), are used to identify the need for administrative and engineered safeguards. IEC 61511 establishes requirements for designing and managing SIS’s to achieve specified safety integrity levels (SIL), which are related to the order of magnitude ranges of risk reduction. When LOPA determines that a SIS is required, the required risk reduction becomes the target SIL for the SIS.

The course is designed to provide the student with an understanding of the required safety management system, how to perform LOPA to identify the need for a SIS and to assign the SIL, how to design the SIS to meet the specified SIL, how to verify that the SIL can be achieved, and how to develop an operating plan to maintain the SIL throughout the SIS life.

Who should attend?
Control systems, instrument, electrical and process safety specialists, PSM managers, and PSM compliance auditors.
Course instructor

Bill Hearn (TÜV functional safety expert)

Agenda

Day 1: Getting Started

◊ Module 1 — SIS Standards Overview.
This course begins with a brief introduction to the various good engineering practices that apply to safety instrumented systems (SISs) implemented in process industry facilities. Special focus is given to international standards, such as IEC 61511 and 61508, and recognized guidance documents, such as the CCPS Guidelines books and several ISA technical reports.

◊ Module 2 — Planning.
An overview of IEC 61511 is presented followed by detailed requirements for the safety management system contained in clauses 5 through 7. Key elements are competence, independent review, verification, functional assessment, management of change and auditing.

◊ Module 3 — Process Risk and Protection Layers.
Process risk derives from process miss-operation and is an inherent part of process design. This inherent risk must be reduced below internationally accepted risk criteria using independent protection layers (IPLs) that are designed and managed to meet seven core attributes.

◊ Module 4 — Establishing Risk Evaluation Criteria
The risk assessment phase is addressed in IEC 61511 Clauses 8 and 9. The initiating events for process hazards are identified, and the frequency and consequence severity of each potential event is estimated. Depending on the type of risk analysis, various conditional modifiers may also be considered when assessing the risk. Once the risk is understood, a risk reduction strategy can be developed.
Day 2: Risk Analysis to Design

◊ Module 5 — Layer of Protection Analysis
Layer of protection analysis (LOPA) is covered in the CCPS book, Layer of Protection Analysis: Simplified Process Risk Assessment. LOPA identifies the initiating events and their frequency, the consequences and their severity, the required risk reduction, and the protective functions implemented in each protection layer to achieve the required risk reduction.

◊ Module 6 — Safety Requirements Specification (SRS) Part 1
The SRS in IEC 61511 Clause 10 is a collection of information that specifies the SIS design basis required to ensure process safety during all operating modes. The SRS defines the functionality, integrity, reliability, operability and maintainability requirements based on operational goals, intended operating modes and process safety time limitations.

◊ Module 7 — Safety Requirements Specification Part 2
IEC 61511 Clause 11 provides many specific design requirements including the need for fault tolerance and separation of the SIS from the BPCS.

◊ Module 8 — Selection of Devices
SIS device selection is addressed in IEC 61511 Clause 11.5. ISA TR84.00.04 guidance is presented related to field devices and logic solvers. Emphasis is placed on demonstrating that the device is user-approved for safety based on a review of manufacturer information and actual field experience.
Day 3: Verification and Operating Basis

◊ Module 9 — Data Estimation
IEC 61511 Clause 11.9 requires verification of the SIS performance through calculation of the probability of failure on demand (PFD) and the spurious trip rate of the SIS as specified and maintained. Various types of data estimates are discussed with an emphasis on collecting internal and industrial data.

◊ Module 10 — Design Decisions
The voting architecture, diagnostic coverage, proof test interval, and common cause failure potential affects the achievable PFD, and the spurious trip rate. The impact of each design decision is discussed and typical examples are presented.

◊ Module 11 — Example Verification
An example of safety instrumented functions (SIF) will be assessed to illustrate how choices in field device architecture, test interval and logic solver technology affect the achievable PFD and spurious trip rate.

◊ Module 12 — Operating Basis
There are many day-to-day operational and maintenance activities that must take place for the SIS to sustain its expected performance throughout its installed life. Operation and maintenance procedures must be developed and verified prior to the introduction of hazards into the process unit. These procedures support the detection and response to faults and process alarms, the initiation of manual shutdown, reset after shutdown, and proof tests.
Description
This 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 to the course.

Who should attend?
Control systems engineers, instrument engineers and process safety specialists.

Course Number: 4132Q  Duration: 2 days

SAFETY INTEGRITY LEVEL (SIL) VERIFICATION
Course instructor

Bill Hearn (TÜV Functional Safety Expert)

Agenda

Day 1

◊ Overview of SIS standards.
◊ Failure fundamentals — failure modes and effects analysis (FMEA).
◊ Introduction to maths 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.

Day 2

◊ Example system
  ○ Impact of diagnostics and need for compensation measures.
  ○ Calculation demonstration showing the impact of redundancy.
◊ Workshops — problems worked by attendees. Various cases will be modeled showing how changes to design and maintenance strategy affect results.
TOXIC GAS RELEASES IN THE OIL AND GAS INDUSTRY: ANALYSIS, PREVENTION AND MITIGATION

Course Number: 3142Q  Duration: 2 days

Description
This course provides an understanding of the properties and effects of toxic gas releases found within the oil and gas industry, with particular attention to hydrogen sulfide (H2S). This course explores various toxic gas release prevention and mitigation measures, concentrating primarily on the selection, location and use of available gas sensing devices. The capabilities and limitations of commercially available (toxic) gas detection technologies will be discussed. The course is focused on fixed gas detection and the optimization of their location using computational fluid dynamics (CFD) and gas release modeling techniques.

Who should attend?
Safety engineers, managers and supervisors, personnel involved in the design, operation or modification of an offshore and onshore oil and gas facilities (platforms, FPSOs, terminals, etc.).

The course is targeted towards individuals who are involved with the design and safe operation of complex onshore and offshore oil and gas facilities and processes where there is the potential for a hazardous gas release with specific reference to hydrogen sulfide, including those involved with general safety, process safety, plant operations, loss prevention, instrumentation and instrumentation maintenance.
Course instructors

Dr. Luc Vechot (MKOPSC-Qatar)
Kevin Dean (Senscient)
Dr. Prankul Middha (Gexcon)
Dr. Kees van Wingerden (Gexcon)

Agenda

Module 1: Toxic Hazard Awareness
◊ Principles of toxicology.
◊ Dose response relationships.
◊ Toxic effects and harm criteria (worker and public exposure limits).
◊ Regulations and standards.
◊ Case study: Toxic hazards of H2S, H2S toxic release fatal incident.

Module 2: Risk Identification, Quantification and Reduction
◊ Principles of risk assessment.
◊ Layers of protection analysis.
◊ Personal protection equipment (PPE, SCBA, SABA).
◊ Emergency response.

Module 3: Toxic Exposure Consequence Analysis
◊ Source terms calculation.
◊ Toxic gas dispersions.
◊ 2-D vs 3-D toxic gas dispersion modeling.
◊ Probit analysis.
◊ Case study: H2S dispersion and toxic exposure modeling.

Module 4: Toxic Gas Detection and Monitoring
◊ Overview of detection option (personal, portable, fixed).
◊ Gas detection technologies: overview and limitations.
◊ Fixed point vs open path detection: performance, location/placement, mounting and maintenance.
◊ Case study.
◊ Economic and safety benefits.

Module 5: Course Summary
Dr. Sam Mannan is Regents Professor in the Artie McFerrin Department of Chemical Engineering at Texas A&M University and director of the Mary Kay O’Connor Process Safety Center in the Texas A&M Engineering Experiment Station. Before joining Texas A&M University, Mannan was vice president at RMT Inc., a nationwide engineering services company. Mannan’s experience is wide ranging, covering process design of chemical plants and refineries, computer simulation of engineering problems, mathematical modeling, process safety, risk assessment, inherently safer design, critical infrastructure vulnerability assessment, aerosol modeling, and reactive and energetic materials assessments. He is co-author of the Guidelines for Safe Process Operations and Maintenance published by the Center for Chemical Process Safety, American Institute of Chemical Engineers. He is the editor of the 3rd and 4th edition of the three-volume authoritative reference for process safety and loss prevention, Lees’ Loss Prevention in the Process Industries. Mannan has published 167 peer-reviewed journal publications, three books, seven book chapters, 183 proceedings papers, 12 major reports and 188 technical meeting presentations. Mannan is the recipient of numerous awards and recognitions. In September 2011, the Technical University of Łódz, Poland, conferred the Doctoris Honoris Causa on Mannan. In 2012, he was awarded the Bush Excellence Award for Faculty in Public Service. Mannan received his B.S. in chemical engineering from Bangladesh University of Engineering and Technology (Bangladesh) in 1978, and obtained his M.S. in 1983 and Ph.D. in 1986 in chemical engineering from the University of Oklahoma (USA).

Dr. Luc Véchot is an assistant professor of chemical engineering at Texas A&M University at Qatar and the managing director of Mary Kay O’Connor Process Safety Center – Qatar. He obtained a Ph.D. in chemical engineering from the École Nationale Supérieure des Mines de Saint-Étienne (France) in 2006. In 2007, he joined the Fire and Process Safety Unit of the Health & Safety Laboratory (HSL) in Buxton.
(UK) as a process safety engineer. Véchot joined the faculty at Texas A&M at Qatar in 2010 where he took over the lead of the process safety research and teaching activities at the university. Véchot has worked on process safety related research topics for the past nine years in collaborations with universities, public laboratories and industries. He has focused his researches on exothermic reaction hazards and calorimetric hazard screening techniques, runaway reactions and adiabatic calorimetry, pressure relief design applications for reactive systems, accidental releases of water reactive chemicals, consequence modeling of LNG spills, combustible dust explosion and dynamic risk assessments. Véchot is also the chairman of the Qatar Process Safety Symposium organizing committee.

**Dr. Tomasz Olewski** is an associate research scientist at the Mary Kay O’Connor Process Safety Center – Qatar. He started his career in process safety in 2007 at the Department of Safety Engineering of Technical University of Lodz, where he was a faculty member and consultant of risk assessment for numerous large oil and chemical plants in Poland. He joined Texas A&M at Qatar in 2009 to support a five-year project on LNG safety (involving laboratory- and medium-scale experimental work) funded by the BP and greatly supported by Qatar Petroleum. He holds a Ph.D. in chemical engineering, an M.Sc. and Engineer Degree in environmental engineering, and diplomas in electrical and automatic engineering and safety in industrial processes.

**Dr. Ioannis Economou** has been a professor of chemical engineering at Texas A&M University at Qatar since January 2013. He is the chair of the Mary Kay O’Connor Process Safety Center – Qatar Technical Advisory Committee. From 2009 to 2012, he was the associate provost for graduate studies and a professor of chemical engineering at the Petroleum Institute, Abu Dhabi, and was previously the laboratory director of the Molecular Thermodynamics and Modeling of Materials Laboratory of the National Center for Scientific Research “Demokritos” in Athens, Greece. Economou holds a Diploma of chemical engineering from the National Technical University of Athens, Greece (1987) and a Ph.D. in chemical engineering from The Johns Hopkins University, USA (1992). He worked as a postdoctoral researcher in Delft University of Technology in the Netherlands (1993–1994), Exxon Research and Engineering Company in New Jersey, USA (1994–1995); research fellow in University College London (1994–1996) and Princeton University (2004); and as visiting professor in the Technical University of Denmark (2001 and 2006–2007) and the American College of Greece (2007–2009).
Dr. Marcelo Castier obtained his B.Sc. (1981) and M.Sc. (1985) in chemical engineering from the Federal University of Rio de Janeiro (UFRJ) and his Ph.D. degree (1988) from the Technical University of Denmark. He was associate professor of chemical engineering at UFRJ from 1988 to 2006 and at the United Arab Emirates University from 2006 to 2010. Since then, he is professor of chemical engineering at Texas A&M University at Qatar where he is faculty fellow of the Mary Kay O’Connor Process Safety Center – Qatar. He was a Fulbright senior visiting scholar at the University of Delaware in the spring of 2006. His research focuses on the development of thermodynamic models; new algorithms for computing thermodynamic equilibrium; applications of thermodynamics to chemical process safety; energy integration; development of educational software. He has supervised (or co-supervised) seven Ph.D. theses and 24 M.Sc. dissertations, and published more than 80 journal papers. He is the developer of XSEOS, an educational Excel-based package for chemical engineering thermodynamics.

Dr. Konstantinos Kakosimos received his Ph.D. on the simulation of toxic gases dispersion from the Chemical Engineering Department of Aristotle University of Thessaloniki (Greece) in 2009. He worked as postdoctoral research fellow/assistant in the same university, as visiting research assistant in the National Environmental Research Institute at Aarhus University (Denmark), and as a design engineer and environmental consultant for a number of private firms (Hellenic Petroleum, Titan Cement Company SA, Hellenic Gold, HYETOS GP etc). He has been an assistant professor of chemical engineering at Texas A&M University at Qatar since October 2012. He is co-author of the book, Fires, Explosions, and Toxic Gas Dispersions: Effects Calculation and Risk Analysis, published by CRC Press and he has published more than 15 papers in international peer-reviewed journals.

Bill Hearn is a TÜV functional safety expert with more than 30 years of engineering and project management experience focused on instrumentation, process measurement, and safety systems. His experience ranges from managing major project installations to performing risk assessments and drill down compliance audits. Bill teaches and consults on layer of protection analysis, safety integrity level certification, safety instrumented system implementation, and establishing setpoints for SIS. He was a member of the API Task Group on Tank Overfill Prevention and actively supports several ISA working groups.
Dr. Jack Chosnek is a consultant in process safety management and knowledge management and has more than 35 years of experience in the petrochemical industry. He has consulted for companies in the chemical, oil and gas, offshore, waste management and mining industries, developing policies and implementing process safety management systems, facilitating PHAs, writing operating procedures and conducting incident investigations and process safety audits. He has developed commercial, full-featured software for PHA facilitation and management of change (MOC). Chosnek consulted as the principal risk engineer for two multibillion-dollar projects carried out by large engineering firms.

Michael J. Snakard, managing director of Snakard Consulting Group LLC, has more than 25 years of experience in the design, permitting, startup and safe operation of onshore and offshore oil and gas facilities, LNG operations, petrochemical plants and other industrial facilities. He has completed health, safety, environment loss prevention and risk assessment projects around the world and has a good understanding of loss prevention requirements, fire protection practices and process safety standards employed to achieve recognized and generally accepted good engineering practice (RAGAGEP). Within the field of process safety and loss prevention he has extensive experience in the safe design, startup, troubleshooting and operation of industrial plant processes. After starting his career as a process engineer involved in the design of industrial processes and expansion projects he worked as the process safety management coordinator for a major refinery in California, USA. He is very familiar with the U.S. OSHA PSM Standard, NFPA Fire Code (NFPA 1), NFPA 13, NFPA 14, NFPA Life Safety Code (NFPA 101), and he is familiar with ASME and ANSI standards and API recommended practices as they pertain to the overpressure protection of pressure vessels, atmospheric tanks and piping systems. He is also very familiar with the Energy Institute, Model code of safe practice Part 15: Area classification code for installations handling flammable fluids (EI 15 - formerly referred to as IP 15). He has lead numerous HAZID, HAZOP, SIL assessment and layers of protection analysis (LOPA) reviews, qualitative and quantitative risk assessments, design reviews, and has conducted audits in the U.S., Canada, Europe, Turkey, Jordan, Iraq, Qatar, UAE, Oman, Thailand, Malaysia, Japan and Australia. In addition he has spoken in conferences and held process safety management-related training classes in the U.S., Qatar, Bahrain, Kuwait, Malaysia and the Philippines. He lived in Qatar from 2004 until 2010, and is currently in the process of setting up a company in Qatar focused on HSE, process safety, loss prevention and risk assessment.
Dr. Ray Mentzer has been a lecturer in the Artie McFerrin Department of Chemical Engineering at Texas A&M University since November 2008 following a 28-year career with ExxonMobil. He teaches the senior-level “Chemical Process Safety” course, as well as “Industrial Safety and Health Management.” Mentzer is also engaged in various research activities as a member of the TEES Mary Kay O’Connor Process Safety Center, focusing on various aspects of process safety, personnel safety, inherently safer technology, security, and LNG. Mentzer received his B.S. in chemical engineering from the University of Illinois, and M.S. and Ph.D. in chemical engineering from Purdue. Before joining Texas A&M, Mentzer had more than a dozen assignments with ExxonMobil, lastly as the safety, health, environment and security manager for ExxonMobil Development Company, providing support to world-wide projects associated with the production and processing of oil and gas. Prior to that he had a variety of assignments in Houston, London and New Orleans, taking him to many corners of the earth.

Dr. Simon Waldram joined ICI Agricultural Division as a student apprentice in 1964 and studied chemical engineering in the UK and U.S. He was awarded his Ph.D. from the University of London where he was a faculty member (at University College London) for 21 years before spending 15 years as technical director and then director for business development at Hazard Evaluation Laboratory Ltd. In 2007 he joined Texas A&M at Qatar as professor of chemical engineering and was later interim head of the program until December 2010. He is currently owner and managing director of Waldram Consultants Ltd. where his recent projects have been in the areas of process safety, runaway reactions, expert opinion and expert witness in a fatal accident inquiry, undergraduate teaching, and continuing professional development and faculty selection for the engineering programs in a new university in Asia. He is an honorary faculty member of the Chemical Engineering Department at University College London and is a visiting research fellow at the TEES Mary Kay O’Connor Process Safety Center at Texas A&M University in College Station, Texas, USA. He has written and published extensively and is author of more than 100 papers, approximately half of which are in the field of process safety.
David Onchagwa is assistant manager of health, safety, security and environment at Texas A&M at Qatar in the Office of HSSE and Building Operations. He started his career as a field chemist for a hazardous waste disposal company in New York in 2001 and then joined Columbia University Medical Center in New York City as a laboratory safety specialist in 2004 before moving to Qatar as laboratory coordinator in 2008. He has an M.A. in environmental management and is a certified safety and health manager (CSHM), certified hazardous materials manager (CHMM) and certified Environmental safety and health trainer (CET).

Khaled Elsaid is the laboratory manager in the Chemical Engineering Program at of Texas A&M at Qatar. Elsaid has more than 10 years of combined research and academic teaching experience that he gained by working for different research and academic institutions. Before joining Texas A&M at Qatar in 2007, Elsaid worked for the chemical engineering department at Minia University, ore treatment lab at the Central Metallurgical Research and Development Institute CMRDI in Egypt, as well as collaborating with the University of Waterloo in Ontario, Canada, in ongoing research work. Elsaid holds a B.Sc. and an M.Sc. in chemical engineering with a main research focus in environmental and safety engineering, in which he joined different research projects in this field, which involved deep collaboration with different academic and industrial entities in Egypt and Qatar.

Kevin Dean is a regional manager for Senscient with more than 30 years of experience in gas-sensing technologies, gas-detection products and their applications. Kevin has an engineering qualification and has formerly worked for Honeywell Analytics (and formerly Zellweger Analytics), manufacturers of fixed and portable gas detection, and Xtralis, manufacturers of the “VESDA” range of very early smoke detection and alarm systems. During his career, Kevin has held positions in sales, marketing, product applications and training.
Dr. Prankul Middha is a principal engineer at Gexcon. He has a bachelor's degree in chemical engineering from the Indian Institute of Technology in Delhi, India; a master's degree in mechanical engineering from the University of Delaware, USA, in the area of combustion modeling; and a Ph.D. in process safety from University of Bergen, Norway, focusing on safety related to hydrogen applications. He has a long experience within the industry working in both R&D, training, software sales and support, and advisory services, with the main focus being consequence modeling for release, dispersion, explosion and fire modeling. He has worked in India, USA, Norway and the UK. Prankul has 25 published papers in international peer-reviewed journals and has given 70 presentations in international conferences.

Dr. Kees van Wingerden is the senior vice president and technical director for Gexcon. Kees started his career in the Dutch research institute TNO (department of gas and dust explosions) in the late 1970s. In 1991, he started working at CMR/Gexcon. In 2002, he became responsible for selling explosion protection equipment in INCOM Explosionsschutz in Switzerland and Kidde Brand –und Explosionsschutz in Germany. Kees returned to Gexcon in 2007. He has more than 35 years' experience in the field (research, testing, advisory service, risk analysis). He is the chairperson for the European committee CEN/ TC 305 WG3 “Devices and systems for explosion prevention and protection.”