594752 (M)
IDC Training House
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TUV / IICS 2.8
QUANTITATIVE RISK ANALYSIS

COURSE DURATION: 6 DAYS

COURSE DESCRIPTION

This course is designed to help participants gain basic understanding of risk concepts and processes in typical industries, better understand risk and uncertainty, and improve decision making through Quantitative Risk Analysis (QRA). It also aims to enhance participants' knowledge in the field of accident and consequences modelling, especially on gas explosion and dispersion, as well as fire modelling.

Risk analysis modelling, FTA analysis and probability assessment, as well as the procedural and organizational requirements towards building an effective process safety management system (PSMS) will also be covered in this course.

COURSE OBJECTIVE

The course provides participants with the knowledge necessary to:

- Learn to model the consequences
- Learn to assess the probabilities and built failure trees (FTA analysis)
- Learn and practice the main principles and techniques in QRA
- Understand how to employ QRA to better understand risk and uncertainty and improve decision-making

COURSE OUTLINE

DAY 1

Module 1: Introduction

- QRA Definition
- Key documents and data sources
- Key modelling tools – publicly available and commercial

Module 2: Basics of the QRA Study

- Complete QRA procedure
- Scope
- Incident management
- QRA Procedure application
- Limitation of QRA
- Utilization of QRA results
- QRA Study – goals, objective, depth, special requirements
- Maintenance of study results
- Requirements Europe / Seveso II and Seveso III, USA / EPA

Module 3: Process Safety management (PSM) system

- PSM Auditing questionnaire – different requirements and approaches
- PSM auditing questionnaire – sources of information and responsibilities
- CASE STUDY – own company assessment, interpretation of the results

WHO SHOULD ATTEND

- Engineers, managers, project management team, inspectors, legislators, designers, HSE engineers from petrol and petrochemical, refining, chemical and oleochemical plant, paper mills, other individuals' plant.
- Professionals dealing with risk and safety in industry
- Individuals with no previous experience in the field of QRA

DAY 2

Module 3: Consequence modelling – part 1

- Source modelling
  - Discharge rate models
  - Flash and evaporation
  - Dispersion Models
- Understanding release, release sequences and constructing event trees
- Different release models and data requirements
- Necessary physical data for pure substances
- Modelling of mixture releases
- CASE STUDY – release modelling of pure substance / gas release
- CASE STUDY – release modelling of pure substance / liquid release
- CASE STUDY – release modelling of mixture/two phase release

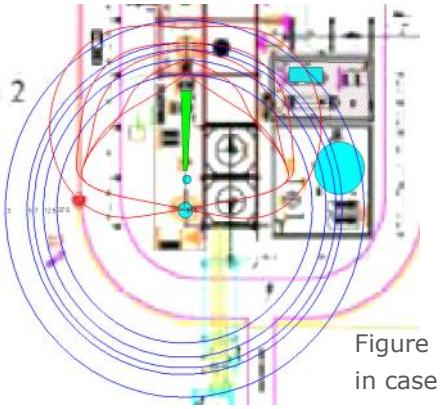

Figure 1: Various endpoints of radiation in case of explosion

Module 4: Consequence modelling – part 2

- Types of consequences
  - Blast effects / overpressure effects
  - Projectiles
  - Thermal radiation
  - Effects on structures and humans, threshold values
  - Toxic effects
  - Other consequences to be considered – economy, environment, reputation
- Atmospheric conditions effects
- Explosion and fires / blasts
- Vapor Cloud explosion
  - TNT model
  - Multi-explosion model
- Physical explosions
- BLEVE and Fireball
- Confined explosion
- CASE STUDY – modeling of Vapor cloud explosion using TNT model
- CASE STUDY – modelling of the BLEVE / Fireball effects

DAY 3

Module 5: Consequence modelling – part 3

- Fire modelling
- Pool fires
- Jet fires
- CASE STUDY – pool fire modelling / modelling of thermal effects
- Modelling of dispersions
- Simple models
- Jets and plumes
- Dense gas models / ALOHA model
- Application of the dispersion models for flash fire modelling
- Application of the dispersion models for toxic effects modelling
- CASE STUDY – flash fire modelling
- CASE STUDY – Toxic release modelling

Module 6: Consequence reduction

- Fault tree analysis
- Barriers and their effectiveness
- Active fire protection
- Active blast / explosion protection

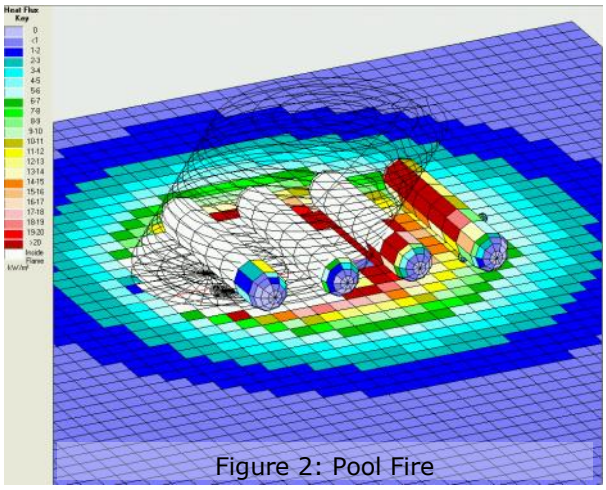

Figure 2: Pool Fire

DAY 4

Module 7 Probability of release calculations

- Methods for identification of failure scenarios
- Fault tree construction
- Incident types, frequencies and data sources
- Accident Sequence Development and Quantification
- Internal and external incident sources
- External events analysis
- Human Failures/ human reliability analysis
- Barriers and their effectiveness assessment
- CASE STUDY – Fault tree development
- CASE STUDY – Barriers/ Layers of protection assessment

Module 7: Measurement, Calculation, and Presentation of Risk Estimates – part 1

- Bow-Tie approach – combining the Fault tree analysis and Event tree analysis
- CASE STUDY – Bow-tie development
- Risk measures
  - Individual risk
  - Societal risk
  - Injury risk measures
- Risk presentation
  - Risk indices
  - Individual risk
  - Societal risk
- Selection of Risk Measures and Presentation Format

DAY 5

Module 8: Measurement, Calculation, and Presentation of Risk Estimates – part 2

- Risk Calculations
  - Individual
  - Societal
  - Risk indices
- CASE STUDY - Example Risk Calculation Problem

Module 9: QRA Database and documentation

- Historical Incident Data - Types of Data and Sources
- Process and Plant Data - Plant Layout and System Description and Ignition Sources and Data
- Chemical Data - Types of Data and Sources
- Environmental Data – Population, Meteorological, Geographic and Topographic Data
- External Event Data
- Equipment Reliability Data - Types and Sources of Failure Rate Data, Key Factors Influencing Equipment Failure Rates, Failure Rate Adjustment Factors, Data Requirements and Estimated Accuracy, Collection and Processing of Raw Plant Data
- Human Reliability Data
- Preparation of the CPQRA Equipment Failure Rate Data Set
- CASE STUDY - Sample Problem

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TRAINER'S PROFILE

DANIEL BALOS

MSc in Mechanical Engineering with the specialization in applicative IT and industrial management, PhD in application of data mining techniques on material behaviour modelling for high temperature components.

Almost 20 years of work in research and industrial projects, as well as training activities especially in risk-based inspections for power plants and refining industry. Participated or led more than 20 EU funded projects, and participated in a number of national projects in the area of material research and education abroad.

In these projects, a vast understanding and knowledge about materials, material degradation mechanisms, inspection methods, risks has been accumulated. Project and risk management skills are proven in numerous projects in last 10 years. Sub-project leader and part of the management team for iNTeg-Risk project (2008-2013).

In the area of QRA, intensively worked and modelled the consequence models in various key RBI projects in Europe - RIMAP (Risk based inspection and maintenance procedures for European industry) – work in development and implementation of RBI approach; as well as creation of safety reports and emergency plans for plans in EuropeAid projects in Serbia and Turkey.

Participation in the implementation project of QRA projects for NIS Serbia, Government of Serbia and Turkey, QP Qatar. Participation in RBI implementations for NIS Serbia, EnBW Germany, as well as MOL, Hungary, ESKOM in South Africa, QP in Qatar, SINOPEC in China and KNPC Kuwait/Fluor The Netherlands. Teaching RBI techniques and holding courses in QRA/RBI related areas for petrochemical and power industry since 2005, with successful courses delivered in Germany, the Netherlands, Serbia, Romania, China, Malaysia, Vietnam and Egypt.