

Fire and Gas System Engineering – Performance Based Methods for Process Facilities

An essential and complete guide to fire and gas system engineering for process facilities using performance based methods including detector mapping with hands-on learning experiences! Includes comprehensive case study examples employing Kenexis Effigy™ FGS performance modeling software and in depth modeling demonstrations.

Course Instructors



Mr. Sean Cunningham
Senior Engineer and
Fire and Gas System Design
Product Manager

Or



Mr. Kevin J. Mitchell, PE
Vice President and COO

**Students of the Course
will require a computer
with internet access to
complete the case study
exercises!**

Expert training on these vital issues:

- **Understand** the scope of fire and gas engineering for process facilities and the myriad standards, regulations, and requirements
- **Review** the fire and gas system design methods and guidelines that are currently available including their strengths and limitations
- **Understand** the Safety Lifecycle (per IEC 61511 / ISA 84 and ISA TR84.00.07) and how they can provide a framework for functional safety of Fire and Gas Systems
- **Learn** how to identify and define the fire and gas zones along with the hazards contained in those zones.
- **Understand** quantitative consequences analysis and how it is employed in performance-based fire and gas system engineering
- **Analyze** the impact on overall risk of the consequence scenario and the beneficial effect of fire and gas systems using consequence integration and event tree analysis
- **Apply** statistical analysis, industry databases and data integration techniques to assess the likelihood of fire and gas system relevant events
- **Assess** the tolerability of the risk posed by a process facility before and after application of fire and gas detection and suppression systems using risk integration techniques
- **Experience** the strengths and limitations of the technology options for fire and gas detection sensors through live fire demonstrations
- **Apply** fire detection coverage mapping and gas detection coverage hands-on using the Kenexis Effigy FGS system performance assessment tool
- **Determine** the impact of the probability of failure on demand of fire and gas system equipment on the overall risk profile of a process facility
- **Understand** the impact of mitigating the magnitude of consequences of fire and gas release events on the overall process plant risk and the difference between prevention and mitigation

Kenexis is an engineering and consulting firm specializing in the application of instrumented safeguards, such as fire and gas systems, to the process industries. Our years of experience give us unparalleled insight into specifying and verifying the safety requirements of a wide range of processes.

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Training Course Overview

Fire and gas detection and suppression system design techniques that are currently in use are often considered to be unsatisfactory due to their nature of being rule of thumb and experience oriented without any real ability to quantify risk. This has resulted in systems that are either overdesigned or under-designed. The advent of the IEC 61511 (ISA 84) standard caused people to start thinking quantitatively, but failed to solve the fire and gas problem because it was not comprehensive enough to consider the real problem, detector coverage. Only after the ISA TR 84.00.07, was a comprehensive framework for performance-based fire and gas design established. This course describes the techniques recommended in the technical report, along with hands-on use of the techniques and associated software tools. This course was designed for all audiences, ranging from a one-day overview of the topic to a full four-day comprehensive master class. The course includes a comprehensive case study that involves employing the Kenexis Effigy™ software to develop a complete performance-based design for a sample oil and gas production facility.

This course is part of the core curriculum required to allow you to become a Kenexis certified user of the Effigy software platform for fire and gas system design.

Section 1 – Introduction

- ◆ Overview and definitions
- ◆ Examples of fire and gas systems
- ◆ Legal requirements and good engineering practices
- ◆ Performance-based FGS

Section 2 – Fire and Gas Hazards

- ◆ Attributes of hydrocarbon fires
- ◆ Characteristics of combustible gas releases
- ◆ Toxic gas hazards
- ◆ Other special hazards safeguarded by FGS

Section 3 – The FGS Lifecycle

- ◆ Relationship to ISA/IEC Safety Lifecycle
- ◆ ISA Technical Report Concepts
- ◆ FGS Engineering Design Lifecycle

The course also includes an exercise including an overview of the use and navigation of the Effigy™ Software Tool.

Section 4 – Risk Concepts and FGS Screening Analysis

- ◆ Risk definitions
- ◆ Risk parameters effected by FGS
- ◆ Risk Model (Event Tree Analysis)
- ◆ FGS considerations in PHA/LOPA/QRA
- ◆ FGS screening analysis

The course also includes an exercise hazard identification and FGS screening.

Section 5 – FGS Philosophy

- ◆ Objectives of FGS philosophy definition
- ◆ FGS philosophy elements

The course also includes an exercise in defining FGS Philosophy criteria and overall plant information for the Sample Plant Case Study using the Effigy™ Software Tool.

Section 6 – Detector Technology Selection

- ◆ Fire detection
- ◆ Combustible gas detection
- ◆ Toxic gas detection
- ◆ Special Topics
- ◆ Special Demonstration*

*When held at Kenexis Headquarters in Columbus, OH, USA, this is a live fire demonstration. In other locations, a recorded demonstration will be presented

Section 7 – Zone Definition

- ◆ Objectives and guidelines for zone definition
- ◆ Area coverage versus segregation
- ◆ Site survey

The course also includes an exercise in zone definition and categorization.

Section 8 – Selecting FGS Performance Requirements

- ◆ Performance targets based on risk
- ◆ Hazard assessment options
- ◆ Fully quantitative methods for assessment
- ◆ Semi-quantitative methods for assessment

The course also includes an exercise in performance requirement selection using both fully quantitative and semi-quantitative approaches.

Section 8 – Selecting FGS Performance Requirements - Continued

The course also includes an exercise in area grade definition.

The course also includes a zone definition and categorization and area grading for the Sample Plant Case Study using the Effigy™ Software Tool.

Section 9 – Detector Coverage Assessment

- ◆ Fire geographic coverage
- ◆ Fire scenario coverage
- ◆ Gas geographic coverage
- ◆ Gas scenario coverage

The course also includes an exercise in detector placement for the Sample Plant Case Study.

Section 10 – FGS Safety Availability

- ◆ SIL versus FGS Safety Availability
- ◆ FGS function definition
- ◆ FGS safety availability calculation

The courses also include an exercise involving calculation of safety availability for FGS functions.

The course also includes an exercise in the interpretation of FGS mapping results and methods for results improvement.

Section 11 – FGS Requirements Specifications

- ◆ General FGS requirements
- ◆ FGS functional specifications
- ◆ Special considerations for FGS

Section 12 – FGS Performance and Testing Standards

- ◆ Performance standards
- ◆ Installation validation
- ◆ Performance validation
- ◆ Validation of FGS mapping

IMPORTANT LIMITATIONS TO COURSE CONTENT!!!

◆ The course is primarily focused on the use of fire and gas detection systems in outdoor or semi-enclosed process areas. Details of fire alarm systems for occupied buildings are only discussed with regards to buildings that support the production facility, but are not comprehensive enough to cover any application for fire alarms to any commercial endeavor. For that we recommend NFPA 72 training from the National Fire Protection Agency (NFPA)

◆ The course discusses quantitative consequence analysis, such as dispersion modeling, explosion modeling, and fire modeling, but does not provide specific details as to the techniques for performing these tasks. Prior to undertaking the comprehensive master class for Effigy User Certification you will be required to either take the Kenexis Chemical Process Quantitative Consequence Analysis (CPQCA) course, or approved* equivalent.

◆ This course discusses how the unreliability (i.e., probability of failure on demand – PFD) of a fire and gas loop impacts the overall effectiveness of a fire and gas strategy and the design factors that influence the PFD that is achieved by various design options, but this course does not provide comprehensive instruction on the methods for performing PFD calculations. Prior to undertaking the comprehensive master class for Effigy User Certification you will be required to take the Kenexis Safety Instrumented Systems Engineering Part 2 – Conceptual Design Evaluation / SIL Verification course, or approved* equivalent.

◆ This course discusses options for mitigating fire such as sprinklers, and chemical suppressant systems, but does not provide detailed instructions on the design of these systems. Design of sprinkler and fire suppressant systems is thoroughly documented in national and international standards such as those from the National Fire Protection Agency (NFPA), and detailed training on the implementation of those standards is available directly from those organizations.

Who Should Attend?

- ◆ Control Systems Engineers
- ◆ Fire and Gas System Specialists
- ◆ Process Safety Professionals
- ◆ Engineering Management

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