

**Arthur Pierce**  
**Senior Engineer, Kenexis****Fields of Competence**

Safety Instrumented Systems Engineering  
Layer of Protection Analysis (LOPA)  
Safety Integrated Level (SIL) Selection  
Safety Integrated Level (SIL) Verification  
Safety Requirements Specification (SRS)  
Functional Test Plans  
Fire and Gas System Design  
Quantitative Consequence Modeling  
Computational Fluid Dynamics  
Quantitative Risk Assessment (QRA)  
Fault Tree Analysis (FTA)

**Experience Summary**

**Mr. Pierce** is a Senior Engineer at Kenexis with 10 years of experience in Fire and Gas Systems (FGS) and Safety Instrumented Systems (SIS). He is involved in risk-based studies in upstream oil & gas production, petroleum refining and specialty chemicals. Mr. Pierce is responsible for engineered safeguard design basis development and verification/validation projects. He is also specialized in performance-based FGS design including risk-based techniques for FGS integrity analysis and fire & gas detector mapping techniques.

**Credentials**

B.S.Ch.E., Chemical Engineering, The Ohio State University, 2014

ISA/IEC 61511 SIS Expert – Safety Instrumented Systems Expert  
Qualified on Safety Instrumented Systems – Front End Engineering Design Part 1 and Part 2  
Completed Kenexis Fire and Gas System Design Training  
Completed Kenexis Burner Management System Training

**Affiliations**

International Society of Automation (ISA)  
2014-Present

American Institute of Chemical Engineers (AIChE)  
2010-Present

**Key Assignments**

Performed SIL selection and verification studies on ammonia plants in Trinidad. Project responsibilities included development of Safety Instrumented Function (SIF) list, SIL selection using LOPA methodology for both existing and proposed systems, quantitative reliability analysis to verify achievement of SIL targets through the use of fault tree analysis (FTA) and developing the safety requirement specifications for the SIS. Systems analyzed include:

- Compressor Systems
- Ammonia Scrubber
- Boiler System
- Fired Heaters
- Primary Steam Methane Reformers
- Secondary Reformers
- Methanators
- Steam and Condensate Systems
- CO<sub>2</sub> Absorption/Stripping Systems
- Glycol Drying Systems
- Refrigeration Unit
- Onshore Gas Processing Facilities

Developed a SIS design basis for the overpressure protection of an African FLNG turret system. Project responsibilities included development of Safety Instrumented Function (SIF) list, SIL verification including complex architecture calculations with the use of fault tree analysis (FTA), and development of the safety requirement specifications for the SIS.

Developed a SIS design basis for a US phenol production facility. Project responsibilities included development of Safety Instrumented Function (SIF) list, SIL verification including complex architecture calculations with the use of fault tree analysis (FTA), and on-site development of the safety requirement specifications for the SIS.

Participated in the design of a HIPPS for a US butanediol production facility. Project responsibilities included SIL selection using LOPA methodology for the proposed system, SIL verification with justification for HIPPS in lieu of conventional pressure relief systems, and development of the safety requirement specifications for the HIPPS.

Developed functional test procedures for instruments and functions associated with the SIS of a US refinery low sulfur gas unit. The procedures included an overview of the test being performed; tools, equipment and interfaces used, detailed description of the required actions to be taken, and pass/fail criteria for the test. The test and inspection procedures conformed to the requirements of ISA / IEC 61511 for SIF.

Participated in Fire & Gas System design and validation projects for numerous offshore facilities. These projects included both process and non-process areas, incorporating risk-based design for process areas. Projects include hazard identification, risk-based analysis of existing fire & gas systems, FGS SIL assessment, design of fire & gas system and, fire & gas detector coverage mapping analysis.

- Offshore Oil & Gas Production
- Gas Treatment and Separations Plants
- Offshore Power Generation
- Offshore Water Injection Systems
- Offshore Building Fire and Gas Detection Systems

Performed Fire & Gas System Design for offshore gas processing facility. This facility included well head platforms, gas treatment platforms, separations platform, and indoor & outdoor non-process areas. This study consisted of a site survey, selection of performance targets, fire and gas detection mapping, and recommendations to meet selected performance targets.

Performed Fire & Gas System Design for an offshore oil processing platform. The facility included processing areas such as separations and gas treatment, as well as flare areas, pig launchers and receivers, glycol regeneration system, and utility areas. This study consisted of selection of performance targets, fire and gas detection mapping, and recommendations to meet selected performance targets.

Performed Fire & Gas System design and validation projects for an Australian onshore LNG facility. The project included review of fire and gas zones, analysis of hazards and definition of fire and gas performance targets, design basis consequence modeling, review of field alarming and executive actions philosophy, FGS safety availability calculations, and fire and gas mapping to verify that the proposed detector layout achieves coverage performance targets. Systems analyzed include:

- Inlet Facilities / Gas Separations
- Acid Gas Removal
- Dehydration & Mercury Removal
- Refrigeration / Liquefaction Unit
- LNG Storage & Loading
- Refrigerant Storage
- Power Generation
- Flare Systems
- Fuel Gas / Hot Oil / Utilities Systems

Performed Fire & Gas System design and validation projects for a Middle Eastern onshore oil production facility and well fluid gathering system. The project included review of fire and gas zones, analysis of hazards and definition of fire and gas performance

targets, design basis consequence modeling, detector technology selection, and fire and gas mapping to verify that the proposed detector layout achieves coverage performance targets. Systems analyzed include:

- Well pads
- Water and Chemical Injection Facilities
- Oil and Gas Stabilization
- Oil and Gas Exporting
- H<sub>2</sub>S Stripping
- Flare Systems
- Fuel Gas / Hot Oil / Utilities Systems

Performed gas detector mapping of natural gas release scenario in a laboratory using dynamic Computational Fluid Dynamics (CFD) modeling. Dispersion modeling of the gas release considered the interaction of the release with objects in the near-field and the influence of mechanical ventilation. The model indicated likely locations of accumulation in detectable concentrations and the time that is required to accumulate a detectable concentration, allowing for optimization of detector placement.

Performed Fire & Gas System Design for a compressor deck at a US olefin production facility. The project included analysis of hydrocarbon fire and combustible gas hazards to define performance targets, design basis consequence modeling using computational fluid dynamics (CFD), and fire and gas detector mapping and coverage assessment.

Participated in a focused quantitative risk assessment (fQRA) on a Central Asian oil & gas gathering system to address risk of overpressure due to blocked flow. The study identified requirements for protection layers and Safety Instrumented Systems (SIS) in more than 10 gathering centers.