



Technical Safety Engineering: Hazardous Areas, Fire and Gas, ESD and Fire Protection



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Introduction:

Technical safety engineering decides how an oil, gas or process plant detects, contains and survives a loss of containment, yet its deliverables are often issued late, by different contractors, with zone drawings, detector layouts, shutdown logic and fireproofing extents that do not agree. Gaps then surface at commissioning or in operation as uncovered release points, slow depressurisation or unprotected steel. This Core Concept course trains engineers to produce and check the technical safety studies that tie these systems together across project phases. Participants build a Technical Safety Design Basis Dossier for one process unit.

Course Objectives:

- Define technical safety scope, discipline interfaces and deliverables for each project phase from concept select to operations handover
- Classify hazardous areas by release source, grade of release and ventilation and produce zone drawings following IEC 60079-10-1 or API RP 505 approaches
- Design fire and gas detection layouts from mapping coverage targets and link them to the emergency shutdown hierarchy and cause and effect charts
- Specify depressurisation philosophy, passive and active fire protection and firewater demand for hydrocarbon process units
- Analyse escape, evacuation and rescue arrangements and screen fire, explosion and toxic dispersion consequences for escalation
- Compile a safety critical element register with performance standards and a technical safety design basis dossier ready for review

Target Audience:

- Technical safety and loss prevention engineers who prepare fire, gas and shutdown studies on projects
 - Process engineers who set emergency isolation, depressurisation and flare load requirements
 - Instrument and control engineers responsible for detector layouts and cause and effect logic
 - Electrical engineers who prepare zone drawings and select equipment for classified areas
 - Facilities and asset integrity engineers who maintain safety critical elements on operating plants
 - Engineering contractor staff who check and approve technical safety deliverables before issue
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Course Outline:

Day 1: Technical Safety Discipline Across the Project Life Cycle

- Technical Safety Scope Matrix From Concept Select Through FEED, Detailed Design and Operations
- Discipline Interface Map With Process, Instrument, Piping, Electrical and Structural Teams
- Inherent Safety Checklist and Fire Zone Segregation Review for Hydrocarbon Modules
- HAZID Output and Major Accident Event List as Technical Safety Design Inputs
- Technical Safety Philosophy Set and Deliverables Register Baseline

Day 2: Hazardous Area Classification, Fire and Gas Detection and Shutdown Logic

- Zone 0, Zone 1 and Zone 2 Definitions With Grade of Release and Ventilation Assessment
- IEC 60079-10-1 and API RP 505 Approaches to Release Sources and Zone Extent
- Flammable Gas, Toxic Gas, Flame and Heat Detector Technology Selection
- Fire and Gas Detection Mapping: Prescriptive, Geographic and Scenario Coverage Methods
- ESD Level Hierarchy, Cause and Effect Charts and Detector Voting Logic

Day 3: Depressurisation, Fire Protection and Firewater Engineering

- Emergency Depressurisation Philosophy, Blowdown Valve Staggering and Flare Load Limits
- Passive Fire Protection for Hydrocarbon and Jet Fire Exposure: Intumescent Epoxy and Cementitious Systems
- Fireproofing Zone Drawings and Structural Steel Critical Temperature Criteria
- Active Protection Selection: Deluge, Water Mist, Foam and Monitor Coverage for Process Units
- Firewater Demand Calculation, Ring Main Hydraulics and Firewater Pump Sizing Basics

Day 4: Escape, Evacuation, Consequence Modelling and Safety Critical Elements

- Escape, Evacuation and Rescue Analysis: Escape Routes, Muster Areas and Temporary Refuge Impairment
- Jet Fire, Pool Fire and Thermal Radiation Contour Modelling for Escalation Screening
- Vapour Cloud Explosion Overpressure and Blast Load Estimation at Overview Level
- Toxic Gas Dispersion Modelling and Hydrogen Sulphide Exposure Footprints
- Safety Critical Element Register and Performance Standards: Functionality, Availability, Reliability and Survivability

Day 5: Technical Safety Design Review Case Work and the Design Basis Dossier

- Gas Processing Module Case: Zone Drawing and Detector Layout Review
 - Refinery Unit Case: Depressurisation Timing and Fireproofing Extent Check
 - Onshore Terminal Case: Firewater Demand and Escape Route Challenge
 - Technical Safety Deficiency Log and Operations Handover Verification Plan
 - Technical Safety Design Basis Dossier Presentation and Peer Challenge
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Skills You Will Gain:

- Hazardous Area Zoning
- Detector Coverage Mapping
- Emergency Shutdown Logic Design
- Fireproofing Specification
- Firewater Hydraulic Estimation
- Escape Route Adequacy Analysis
- Consequence Screening
- Performance Standard Drafting

Why Attend This Course:

- Return with a Technical Safety Design Basis Dossier covering zoning, detection, shutdown, fire protection and escape for a unit on your own project or asset
- Check a contractor's zone drawing, detector layout or firewater calculation and find the gaps before approval
- Work on equal terms with process, instrument, electrical and structural engineers when technical safety requirements cross discipline lines
- Compare design practice with engineers from upstream, gas processing, refining, petrochemical and storage terminal facilities

Conclusion:

A process plant is only as safe as the agreement between its zone drawings, detector layouts, shutdown logic, fire protection and escape routes. The course moves from the technical safety role across project phases, through hazardous area classification, fire and gas mapping and shutdown hierarchy, to depressurisation, passive and active fire protection and firewater, then escape analysis, consequence screening and safety critical element performance standards. The final day applies these methods to design review cases and produces a Technical Safety Design Basis Dossier.
