



TRAINING CATALOGUE · CATEGORY B

Consequence Analysis & Risk

Dispersion, fire and explosion modelling, QRA and risk criteria, fire-and-gas mapping, area classification and dust or reactive hazards - turning consequences into design decisions.

5

COURSES

7

TRAINING DAYS

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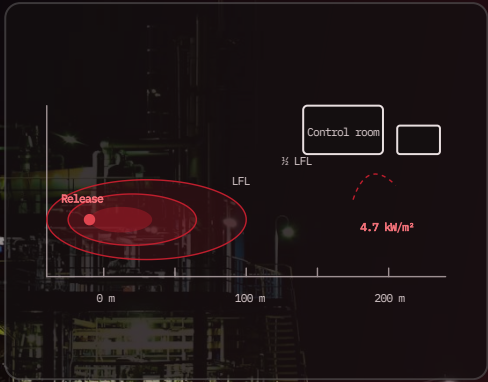
Category B · Consequence Analysis & Risk

CODE	COURSE	DURATION	LEVEL	PRIMARY AUDIENCE
B · Consequence Analysis & Risk				
TR-B01	Consequence Modelling Fundamentals Dispersion, fire and explosion modelling for siting, ERP and PHA decisions	2 days	Intermediate	Process safety and loss-prevention engineers
TR-B02	Quantitative Risk Assessment (QRA) and Risk Criteria Building, interpreting and defending a QRA for land-use planning, safety cases and design decisions	2 days	Advanced	Process safety and loss-prevention engineers
TR-B03	Fire & Gas Mapping and Detection Philosophy Performance-based detector layout, coverage assessment and voting under ISA-TR84.00.07	1 day	Intermediate	Instrument
TR-B04	Hazardous Area Classification (IEC 60079-10) Zoning for gases, vapours and dusts and keeping the drawings alive	1 day	Intermediate	Process
TR-B05	Dust and Reactive-Chemical Hazards Recognising, assessing and controlling the hazards that HAZOP guidewords miss	1 day	Intermediate	Process

CONSEQUENCE & RISK · INTERMEDIATE · 2 DAYS

Consequence Modelling Fundamentals

Dispersion, fire and explosion modelling for siting, ERP and PHA decisions


DURATION
 2 days

LEVEL
 Intermediate

FORMAT
 On-site classroom · virtual instructor-led

LANGUAGE
 English

MAX. PARTICIPANTS
 16

6

worked plant cases

3

model families: dispersion · fire · explosion

1

siting exercise on a plot plan

Overview

Knowing how far a release travels, how hot a fire burns and how far overpressure reaches is what turns a HAZOP consequence into a design decision. The course covers source terms, dispersion, fire and explosion models and — most importantly — how to choose scenarios, interpret contours on a plot plan and defend the results in front of an authority.

Learning outcomes

- Build a credible source term for liquid, gas and two-phase releases
- Select and apply dispersion models for neutral and dense gases
- Estimate pool fire, jet fire, flash fire and BLEVE effects
- Apply TNT-equivalent, multi-energy and Baker–Strehlow explosion methods
- Set harm criteria and map results to buildings and escape routes
- Document assumptions so the study can be revalidated

Who should attend

Process safety and loss-prevention engineers, plant layout and project engineers, emergency-response planners

Course outline

DAY 1

Scenario selection and hole sizes · discharge and flashing · atmospheric stability and weather sets · Gaussian and dense-gas dispersion · toxic dose and flammable extent

DAY 2

Fire models and radiation thresholds · explosion methods and overpressure damage levels · facility siting (API RP 752/753) · worked refinery and LNG cases in CeraImpact · reporting

Standards referenced

CCPS Guidelines for Consequence Analysis

TNO Yellow Book / Purple Book API RP 752 / 753 / 756 API 521

Tools & exercises

Worked cases on CeraImpact with georeferenced plot plans

What's included

- ✓ Course manual and slide pack
- ✓ Software access for the course
- ✓ Post-course Q&A with the instructor
- ✓ Exercise and case-study pack
- ✓ Competency quiz and certificate
- ✓ Templates used in the exercises

PREREQUISITES

Chemical or process engineering background

CERTIFICATION

Certificate of completion

INSTRUCTORS

Practising engineers — TÜV HAZOP Leader, CCPSC and IEC 61511 Functional Safety certified — with 200+ years of cumulative plant experience.

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CONSEQUENCE & RISK · ADVANCED · 2 DAYS

Quantitative Risk Assessment (QRA) and Risk Criteria

Building, interpreting and defending a QRA for land-use planning, safety cases and design decisions

DURATION
2 days

LEVEL
Advanced

FORMAT
On-site classroom · virtual instructor-led

LANGUAGE
English

MAX. PARTICIPANTS
16

1
complete QRA on a live unit

2
criteria frameworks compared

1
event-tree and F-N workshop

Overview

A QRA is a chain of assumptions with a contour at the end, and the contour is only as defensible as the weakest link. The course covers the CPQRA method end to end — scenario and failure-case selection, failure-rate data, event trees, consequence and vulnerability modelling, individual and societal risk aggregation — and then the part that decides the outcome: risk criteria, ALARP demonstration and how to present results to an authority or a project board. Participants build a QRA for a live unit and defend it in a review.

Learning outcomes

- Scope a QRA to the decision it must support and choose the level of detail
- Select failure cases, hole sizes and frequencies from IOGP, HSE and other data sets
- Build event trees with ignition, weather and mitigation branches
- Calculate location-specific and individual risk, F-N curves and PLL
- Apply UK HSE R2P2, Dutch and site-specific criteria and demonstrate ALARP
- Review a consultant's QRA critically and document the assumptions for revalidation

Who should attend

Process safety and loss-prevention engineers, safety-case and Seveso report authors, project engineers reviewing QRA deliverables from consultants

Course outline

DAY 1

QRA purpose and regulatory drivers · CPQRA method and study scoping · failure-case selection and parts count · failure-rate data sources and their limits · ignition probability and event trees · consequence models and vulnerability criteria

DAY 2

Individual risk contours and occupancy · societal risk, F-N curves and PLL · risk criteria: R2P2, Seveso, IOGP · ALARP demonstration and cost-benefit · QRA on a live unit in CeraImpact · reporting, sensitivity analysis and QRA review checklist

Standards referenced

CCPS Guidelines for Chemical Process Quantitative Risk Analysis
UK HSE Reducing Risks, Protecting People (R2P2)
TNO Purple Book (CPR 18E)
IOGP Risk Assessment Data Directory (Report 434) ISO 17776
Seveso III Directive

Tools & exercises

QRA built in CeraImpact with event trees and risk contours on the georeferenced site map

What's included

- ✓ Course manual and slide pack
- ✓ Software access for the course
- ✓ Post-course Q&A with the instructor
- ✓ Exercise and case-study pack
- ✓ Competency quiz and certificate
- ✓ Templates used in the exercises

PREREQUISITES

Consequence Modelling Fundamentals (TR-B01) or equivalent; basic probability

CERTIFICATION

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CONSEQUENCE & RISK · INTERMEDIATE · 1 DAY

Fire & Gas Mapping and Detection Philosophy

Performance-based detector layout, coverage assessment and voting under ISA-TR84.00.07



DURATION
1 day

LEVEL
Intermediate

FORMAT
On-site classroom · virtual instructor-led

LANGUAGE
English

MAX. PARTICIPANTS
16

1

coverage map on your plot plan

4

detector technologies compared

1

F&G philosophy template

Overview

Fire and gas detectors are usually placed where the pipe rack has a free flange, not where the gas will be. The course explains a performance-based approach: defining detection objectives from the hazard, selecting technologies, setting coverage targets, mapping geographic and scenario coverage on the plot plan, and deciding voting, alarm and executive actions. Participants produce a coverage map and a philosophy outline for one of their own areas.

Learning outcomes

- Write an F&G philosophy that states what the system is for and what it must achieve
- Select flame, point gas, open-path and acoustic detectors for the hazard and environment
- Set coverage targets and assess geographic and scenario-based coverage
- Position detectors using dispersion and fire modelling rather than rules of thumb
- Define voting, alarm and executive-action logic and their effect on availability
- Assess an existing installation and prioritise improvements

Who should attend

Instrument, fire-protection and process safety engineers who specify, lay out or assess fire and gas detection; SIS and F&G system owners

Course outline

MORNING

F&G in the layers of protection · ISA-TR84.00.07 performance-based method · detection objectives and hazard zones · flame, gas, acoustic and toxic detector technologies · coverage targets and detector effectiveness

AFTERNOON

Geographic and scenario-based mapping on the plot plan in CeraImpact · voting, alarm setpoints and executive actions · F&G within the SIS and IEC 61511 · testing, maintenance and performance monitoring · assessment of a participant's existing area

Standards referenced

ISA-TR84.00.07 NFPA 72 IEC 60079-29-1 / -2 ISO 13702
IEC 61511

Tools & exercises

Coverage mapping in CeraImpact on the participants' plot plan

What's included

- ✓ Course manual and slide pack
- ✓ Software access for the course
- ✓ Post-course Q&A with the instructor
- ✓ Exercise and case-study pack
- ✓ Competency quiz and certificate
- ✓ Templates used in the exercises

PREREQUISITES

Instrumentation or fire-protection background; P&ID and plot-plan reading

CERTIFICATION

Certificate of completion

INSTRUCTORS

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CONSEQUENCE & RISK · INTERMEDIATE · 1 DAY

Hazardous Area Classification (IEC 60079-10)

Zoning for gases, vapours and dusts and keeping the drawings alive

DURATION
1 day

LEVEL
Intermediate

FORMAT
On-site classroom · virtual instructor-led

LANGUAGE
English

MAX. PARTICIPANTS
16

8

zone-extent calculations

1

HAC drawing for your unit

2

code frameworks: IEC · API/NFPA

Overview

Hazardous area drawings are often inherited, seldom questioned and frequently wrong. The course covers the classification method of IEC 60079-10-1 and -10-2 — sources of release, release grades, ventilation and dilution, zone type and extent — with worked calculations, and compares it with the API RP 505/500 and NFPA 497 approaches used on North American designs. Participants classify part of their own unit and produce a drawing and data sheet.

Learning outcomes

- Identify sources of release and assign release grades correctly
- Estimate release rates and apply the dilution and ventilation assessment of IEC 60079-10-1
- Determine zone type and extent for gas, vapour and mist releases
- Classify combustible dust areas to IEC 60079-10-2
- Translate between IEC zones and API/NFPA divisions where both apply
- Maintain HAC drawings and data sheets through management of change

Who should attend

Process, electrical and instrument engineers responsible for hazardous area classification; inspection and Ex maintenance staff; project engineers reviewing HAC deliverables

Course outline

MORNING

Flammable atmospheres and ignition · IEC 60079-10-1 method: sources, grades, zones · release rate estimation and dilution degree · ventilation availability and zone extent · eight worked calculations for typical equipment

AFTERNOON

Dust classification to IEC 60079-10-2 · API RP 505 / 500 and NFPA 497 comparison · EI 15 point-source approach · classification of a participant's unit and drawing · data sheets, equipment selection interface and MOC

Standards referenced

IEC 60079-10-1 IEC 60079-10-2

EI Model Code of Safe Practice Part 15 API RP 505 / 500

NFPA 497 IEC 60079-14

Tools & exercises

Zone-extent calculations by hand and spreadsheet following the worked examples of IEC 60079-10-1

What's included

- ✓ Course manual and slide pack
- ✓ Software access for the course
- ✓ Post-course Q&A with the instructor
- ✓ Exercise and case-study pack
- ✓ Competency quiz and certificate
- ✓ Templates used in the exercises

PREREQUISITES

Process or electrical engineering background; familiarity with P&IDs

CERTIFICATION

Certificate of completion

INSTRUCTORS

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CONSEQUENCE & RISK · INTERMEDIATE · 1 DAY

Dust and Reactive-Chemical Hazards

Recognising, assessing and controlling the hazards that HAZOP guidewords miss



DURATION
1 day

LEVEL
Intermediate

FORMAT
On-site classroom · virtual instructor-led

LANGUAGE
English

MAX. PARTICIPANTS
16

2

hazard families in one day

1

dust hazard analysis walkthrough

1

reactivity screening on your chemicals

Overview

Combustible dust and reactive chemistry are the hazards most often absent from a hydrocarbon site's PHA, and both have produced fatal explosions in plants that thought they were low risk. The morning covers dust explosibility, the dust hazard analysis required by NFPA 652/660 and the prevention and protection measures of NFPA 68 and 69. The afternoon covers reactive-chemical screening, incompatibility, thermal runaway and the design and operating controls that keep a reaction inside its envelope.

Learning outcomes

- Interpret dust explosibility data: Kst, Pmax, MIE, MEC and layer ignition temperature
- Carry out a dust hazard analysis on a process handling combustible powder
- Select prevention and protection: inerting, venting, suppression, isolation, housekeeping
- Screen chemicals and mixtures for reactivity and incompatibility hazards
- Assess thermal runaway potential from calorimetry data and set safe operating limits
- Bring dust and reactivity scenarios into the site PHA and MOC process

Who should attend

Process, safety and operations engineers on sites handling powders, polymers, catalysts, monomers, peroxides or other reactive materials; PHA leaders

Course outline

MORNING

Dust explosion mechanisms and case histories · explosibility parameters and testing · dust hazard analysis to NFPA 652/660 · deflagration venting, suppression and isolation (NFPA 68/69) · housekeeping, ignition sources and Ex equipment

AFTERNOON

Reactive-chemical case histories · reactivity screening and compatibility matrices · calorimetry: DSC, ARC and what the data mean · runaway reaction scenarios and emergency relief basis · operating controls, safe limits and PHA integration · reactivity screening on participants' chemicals

Standards referenced

NFPA 652 / NFPA 660 NFPA 68 NFPA 69 NFPA 654

CCPS Essential Practices for Managing Chemical Reactivity Hazards

HSE HSG143

Tools & exercises

Worked exercises with published explosibility and calorimetry data; screening templates supplied

What's included

- ✓ Course manual and slide pack
- ✓ Software access for the course
- ✓ Post-course Q&A with the instructor
- ✓ Exercise and case-study pack
- ✓ Competency quiz and certificate
- ✓ Templates used in the exercises

PREREQUISITES

Chemical or process engineering background

CERTIFICATION

Certificate of completion

INSTRUCTORS

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