Blast Resistant Building Design: Facility Siting, Blast Loads and SDOF Response

19 – 23 April 2027
London - Central London four-star



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Introduction:

Blast resistant building design decides whether people inside control rooms, workshops and contractor trailers survive a process explosion, yet many oil, gas and petrochemical sites still hold occupied buildings that no facility siting study has screened for overpressure, fire or toxic ingress. Portable buildings are moved in without review and legacy control rooms are assumed safe. This Core Concept course trains engineers to screen building occupancy, define blast loads, judge structural response and select upgrade, retrofit or relocation options. Participants produce an Occupied Building Siting and Blast Upgrade Report for one site.

Course Objectives:

- Screen permanent and portable occupied buildings on a process site using the consequence and risk based siting approaches described in API RP 752 and API RP 753
- Define explosion scenarios from congestion, confinement and fuel reactivity and derive side-on overpressure, reflected pressure, impulse and duration for each building face
- Evaluate the dynamic response of walls, roofs, frames and connections with single degree of freedom models, ductility ratios and support rotation limits
- Specify blast-resistant construction for control rooms and occupied buildings, including reinforced concrete, steel framing, blast doors, glazing and HVAC isolation
- Assess fire radiation and toxic gas ingress effects on building occupants and choose shelter-in-place or evacuation arrangements
- Recommend retrofit, relocation or occupancy reduction options and record them in siting study documentation controlled through management of change

Target Audience:

- Process safety and loss prevention engineers who run or review facility siting studies for occupied buildings
- Civil and structural engineers who design or check control rooms, substations and workshops for explosion loads
- HSE engineers who approve the placement and occupancy of portable buildings, trailers and temporary offices
- Project engineers who integrate building blast requirements into plot plans and engineering packages
- Facility and maintenance engineers who own existing buildings and manage upgrade and relocation work

Course Outline:

Day 1: Occupied Buildings, Siting Drivers and Current-State Screening

- Refinery Trailer Explosion Lessons: Portable Building Proximity and Missing Change Review
- API RP 752 Permanent Building and API RP 753 Portable Building Scope Comparison
- Building Occupancy Criteria: Individual and Aggregate Occupancy Load Counting
- Consequence Based, Spacing Table and Risk Based Siting Approaches
- Site Building Inventory Register and First-Pass Hazard Screening Sheet

Day 2: Vapour Cloud Explosion Mechanisms and Blast Load Definition

- Deflagration and Detonation Behaviour: Congestion, Confinement and Fuel Reactivity
- TNT Equivalency, Multi-Energy and BST Prediction Methods Compared
- Blast Wave Parameters: Side-On Overpressure, Impulse, Positive Phase Duration and Negative Phase
- Reflected Pressure, Clearing Effects and Roof, Side and Rear Wall Load Build-Up
- Building Blast Load Specification Sheet: Pressure-Time Histories per Face

Day 3: Structural Response and Blast-Resistant Building Design

- Single Degree of Freedom Model: Equivalent Mass, Resistance Function and Natural Period
- Ductility Ratio, Support Rotation and Low, Medium and High Response Limits
- Reinforced Concrete Wall and Roof Slab Detailing for Dynamic Flexure and Direct Shear
- Steel Frame, Cladding Panel and Connection Design With Dynamic Increase Factors
- Pressure-Impulse Diagrams for Component Damage Level Screening

Day 4: Openings, Fire and Toxic Effects, Retrofit and Relocation

- Blast Door, Frame and Hardware Rating and Anchorage Checks
- Laminated Glazing, Window Frame Bite and Fragment Hazard Levels
- HVAC Air Intake Location, Gas Detection Dampers and Shelter-in-Place Leak Tightness
- Jet Fire and Pool Fire Radiation and Toxic Ingress Assessment for Building Envelopes
- Retrofit Options Matrix: Wall Strengthening, Catcher Systems, Relocation and Occupancy Reduction

Day 5: Siting Study Case Work and the Occupied Building Siting Report

- Gas Plant Control Room Case: Blast Load Derivation and SDOF Wall Check
- Petrochemical Complex Case: Contractor Village and Temporary Office Placement Challenge
- Siting Study Documentation: Assumptions Log, Building Evaluation Forms and Action Tracker
- Management of Change Triggers for New Units, Occupancy Increases and Portable Building Moves
- Occupied Building Siting and Blast Upgrade Report Presentation and Peer Challenge

Skills You Will Gain:

- Facility Siting Screening
- Occupancy Load Assessment
- Explosion Scenario Definition
- Blast Load Derivation
- Dynamic Structural Response Analysis
- Blast Door and Glazing Specification
- Shelter-in-Place Evaluation
- Building Upgrade Option Appraisal

Why Attend This Course:

- Leave with an Occupied Building Siting and Blast Upgrade Report covering building inventory, blast loads, response checks and upgrade actions for your own site
- Question a consultant's blast load or SDOF calculation with a clear view of the inputs that drive the result
- Stop portable buildings and temporary offices being placed in explosion zones through a workable change review
- Compare siting and building design practice with engineers from upstream, gas processing, refining and petrochemical facilities

Conclusion:

People die in buildings that were placed too close to process units or never checked for blast. The course moves from building inventory, occupancy and siting approaches, through vapour cloud explosion mechanisms and blast load definition, to single degree of freedom response, response limits and blast-resistant concrete and steel. It then covers doors, glazing, HVAC isolation, fire and toxic effects and retrofit or relocation options, and closes with case work and an Occupied Building Siting and Blast Upgrade Report.