

Compartment Fire Toxicity: Measurement and Modelling

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 Presentation for Training School on 6-9 June 2013
 "Fire Engineering Research - Key Issues for the Future II"

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Outline

- Introduction
- Objectives
- Project plan & examples of challenges

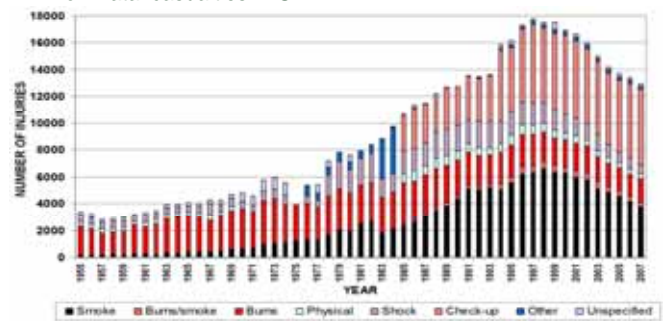
Introduction – 1

- Major Drivers of fire toxicity research
 - Disasters
 - Statistics



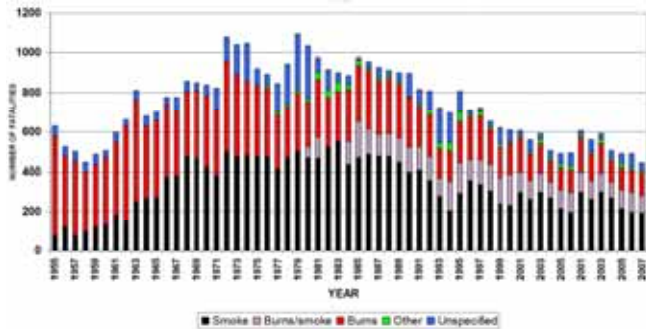
Introduction – 2

- Non-Fatal casualties in UK



Introduction – 3

- Fatalities in UK



Introduction – 4

- Drivers of fire toxicity research
 - Disasters
 - Statistics
- Performance based Design
 - “Performance based design in fire engineering is the application of scientific and engineering principles to the protection of people, property and the environment from fire”
 - Practicality of performance based design
 - Available Safe Egress Time (ASET)
 - Required Safe Egress Time (RSET)

Available Safe Egress Time (ASET)

Ignition, Fire growth, Spread of fire & smoke

Fire
 • Ignition (location + intensity)
 • Fire load (quantity + material content)
 • Smoke nature (release rate + toxic content)

Compartment
 • Size (height) & layout
 • Identification
 • Active & Passive fire protection systems

Hazards from fire reach untenable conditions

Required Safe Egress Time (RSET)

Occupants safety and Fire hazards

Fire + Occupants
 • Physiological influence of exposure to heat & smoke on escape behaviour

Occupants
 • Response to warning
 • Profile (age, physical/mental ability, prep. density)
 • Compartment: fire egress behaviour (way finding, movement, crowd flow)

Compartment
 • Detection & Warning systems
 • Egress routes design (numbers, width)

Occupants reach a place of relative safety

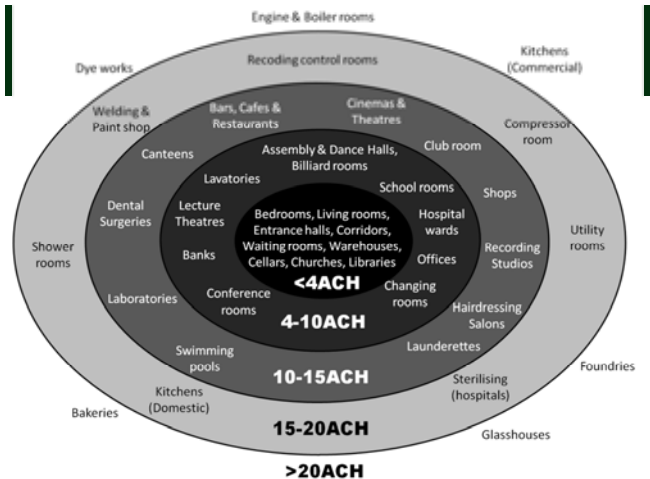
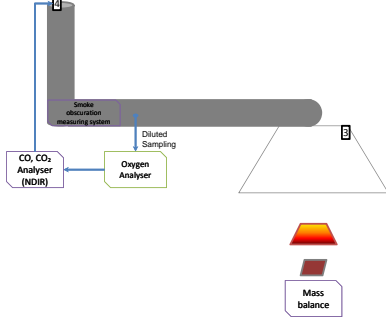


Project Objectives

- To develop and validate a suitable bench-scale test setup (based on the popular apparatus Cone Calorimeter) as a method for evaluating toxicity of materials in enclosed air starved compartment fires.
- Enabling the fast production of detailed toxicity data in relevant and varied fire scenarios.
- Carrying out multi-scale tests and verify toxicity data produced. Developing correlations of toxicity data for CFD modelling

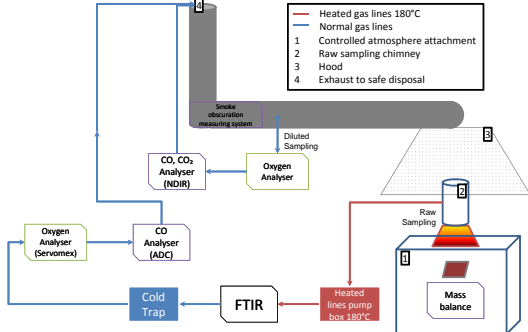
Project Plan – 1

- the cone calorimeter:



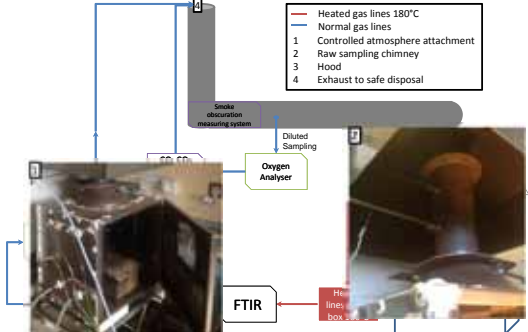
Project Plan – 3

- the cone calorimeter:



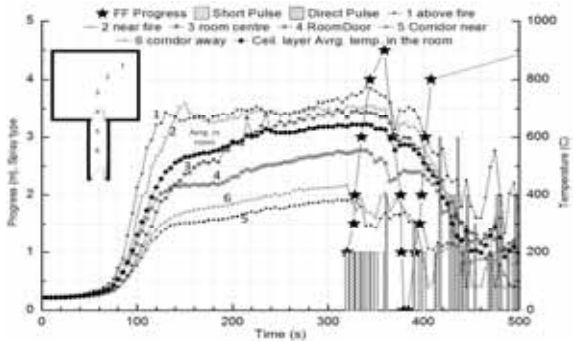
Project Plan – 4

- the cone calorimeter:



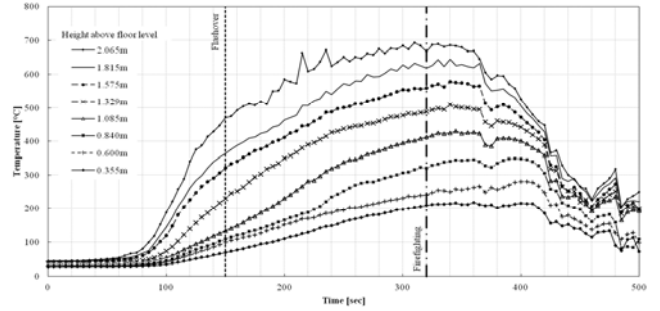
Additional slide 1 – jersey test T3

Ceiling temperature on the path of air ventilation



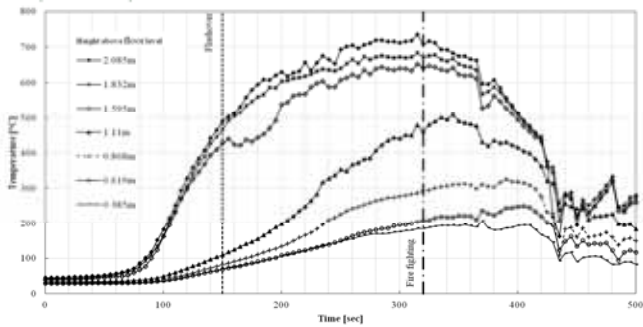
Additional slide 2 – jersey test T3

Central vertical temperature profile on the path of air ventilation



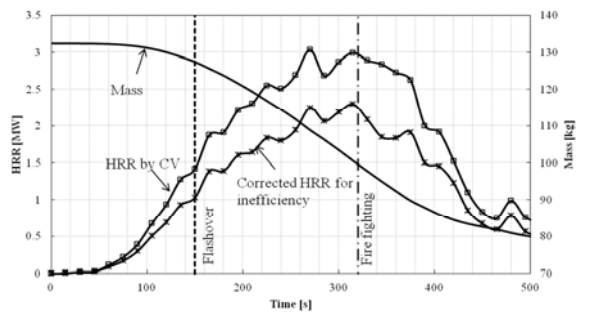
Additional slide 3 – jersey test T3

Sidewall vertical temperature profile away from the path of air ventilation (more stable)



Additional slide 4 – jersey test T3

HRR measurements corrected for combustion inefficiency



Additional slide 5 – Video of Jersey T1



Additional slide 6 – Full furniture fire T8

