

1

Benchmark Analysis # 2

Fire in a Large Hall

Proposal for Part II

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Benchmark Analysis # 2 - Proposal for Part II

2-3 May 2002

2

Objectives of Part II

- To extend scope of Part I to include:
 - a realistic large volume nuclear power plant building
 - turbine hall
 - larger fires
 - producing temperatures capable of greater damage
 - 'target objects'
 - cables
 - structural elements
 - additional complexities:
 - oxygen limitation effects
 - multi-compartment (internal ceiling with openings)

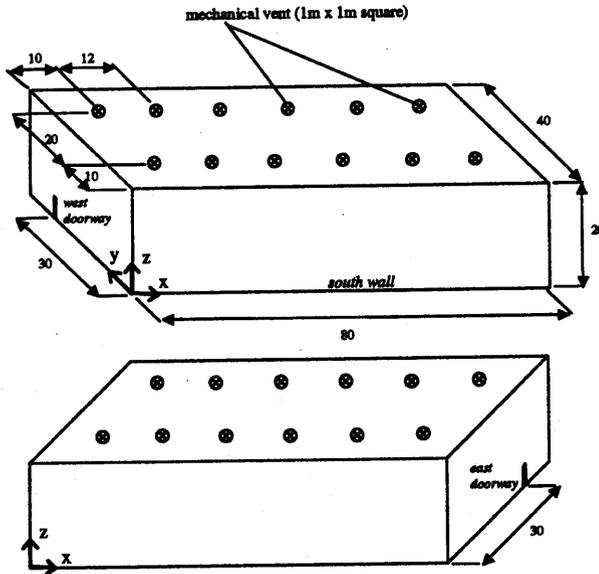
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2-3 May 2002

#3

External Geometry and Vents



To simplify task assume floor, walls and ceiling constructed from concrete

Doorways either 1 x 4 m or 4 x 4 m

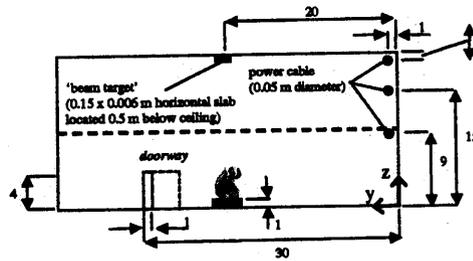
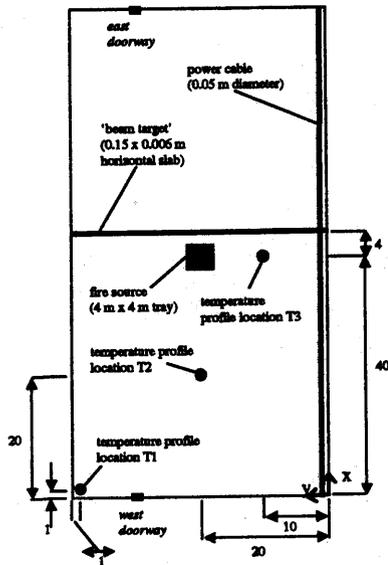
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Benchmark Analysis # 2 - Proposal for Part II

2-3 May 2002

#4

Internal Geometry and Targets



cable target

conductivity (J s ⁻¹ m ⁻¹ K ⁻¹)	density (kg m ⁻³)	specific heat (J kg ⁻¹ K ⁻¹)	emissivity	convective htc (J s ⁻¹ m ⁻² K ⁻¹)
0.082	1710	1040	0.8	10

beam target

conductivity (J s ⁻¹ m ⁻¹ K ⁻¹)	density (kg m ⁻³)	specific heat (J kg ⁻¹ K ⁻¹)	emissivity	convective htc (J s ⁻¹ m ⁻² K ⁻¹)
54	7833	485	0.8	10

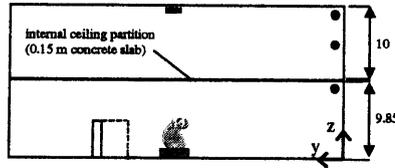
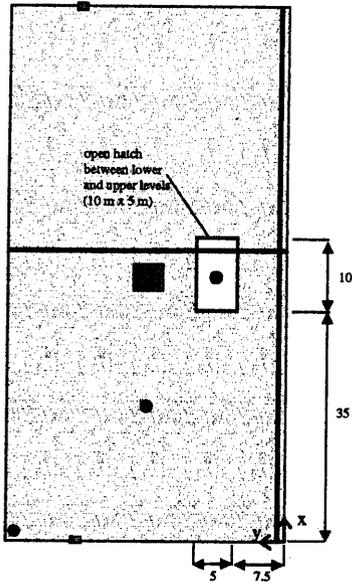
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Benchmark Analysis # 2 - Proposal for Part II

2-3 May 2002

#5

Internal Ceiling



Model as two vertical compartments with one opening (vent) connecting them ?

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2-3 May 2002

#6

Exercises

Case 1a	Case 2a
1m x 4m doorway openings no mechanical exhaust ventilation	1m x 4m doorway openings 16 m ³ s ⁻¹ mechanical exhaust ventilation (divided evenly between the 8 vents)
Case 3a	Cases 1b, 2b and 3b
4m x 4m doorway openings 80 m ³ s ⁻¹ mechanical exhaust ventilation (divided evenly between the 8 vents)	As for cases 1a, 2a and 3a, but with addition of the internal ceiling partition, dividing the volume into two levels

Heptane fuel (as in Part I)

$$\dot{m}_f = \alpha t^2 \quad 0 \leq t < 9 \text{ minutes}$$

$$\dot{m}_f = 1.55 \quad 9 \leq t < 20 \text{ minutes}$$

Reporting procedure as for Part I, plus:

- oxygen level
- target maximum incident flux, surface temp & centre-line temp (and estimate of likelihood of damage)

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Benchmark Analysis # 2 - Proposal for Part II

2-3 May 2002