



# Kent Fire and Rescue Service (KFRS)

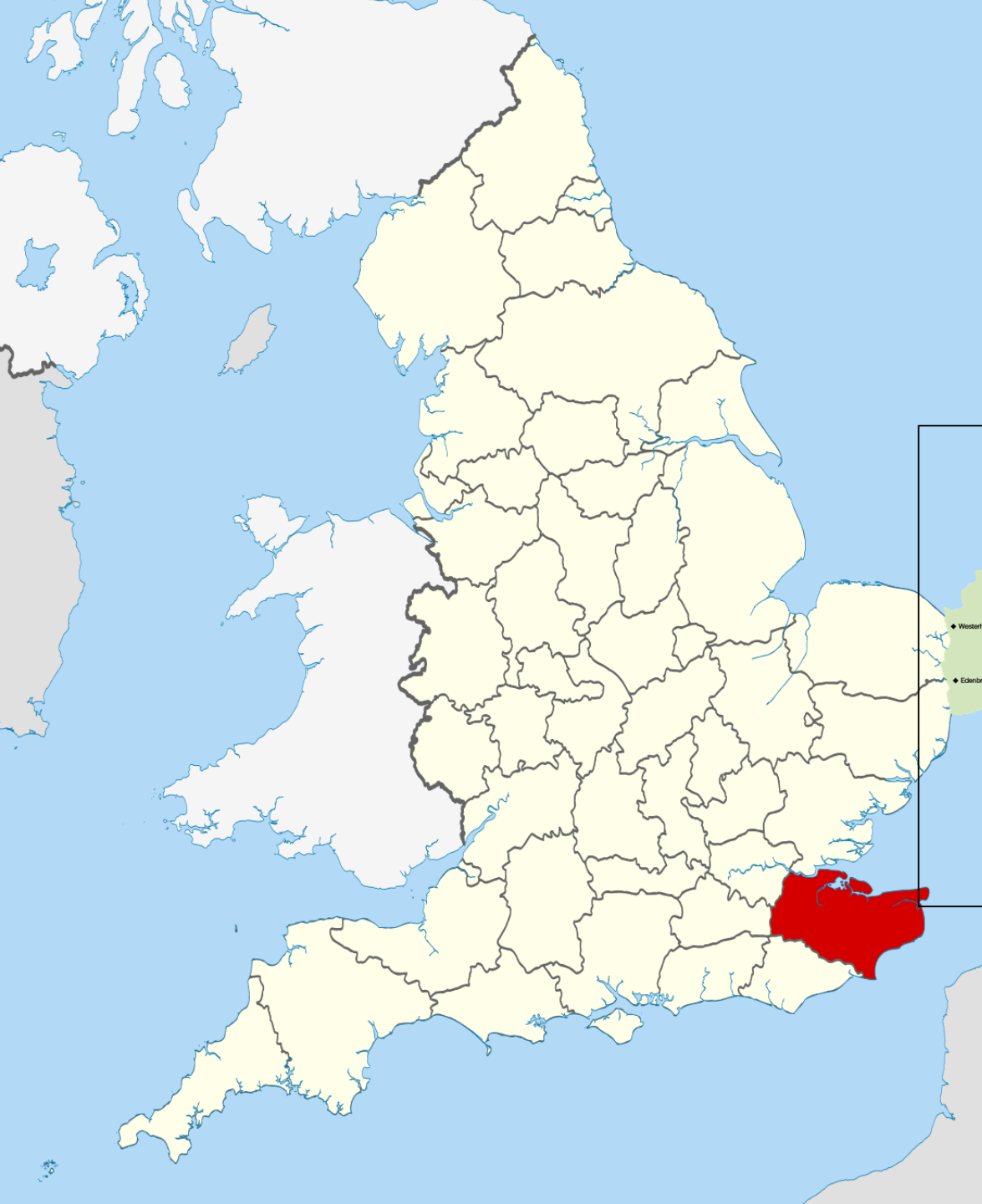
**R.I.C.E**

**Tactical Decision Tool**

*High-rise and Mid-rise Firefighting*



# Kent Fire & Rescue Service





**Kent** Fire &  
Rescue Service

County Area  
3,544 km<sup>2</sup>

**23,047** Call Outs in 2018  
from 56 Fire Stations  
413 people/km<sup>2</sup>

# The aims of this presentation

- When do we make an internal attack our first option?
- Do we evacuate the immediate risk area first?
- At what point do we evacuate an entire building?
- Can we do this without an alarm system and only one stairway?



# 'Stay put' in residential buildings

- Stay where you are unless affected by fire or smoke in your apartment
- **Leave if you feel you may be in danger**, using the stairs and not the lifts
- You are normally safest in your apartment if the fire is elsewhere in the building
- There are no evacuation alarms and most often, only one stair



At what point, if ever, during a firefighting operation in a tall building is it necessary to reverse a 'stay-put' strategy to a partial or total evacuation strategy in a single stair high-rise building?

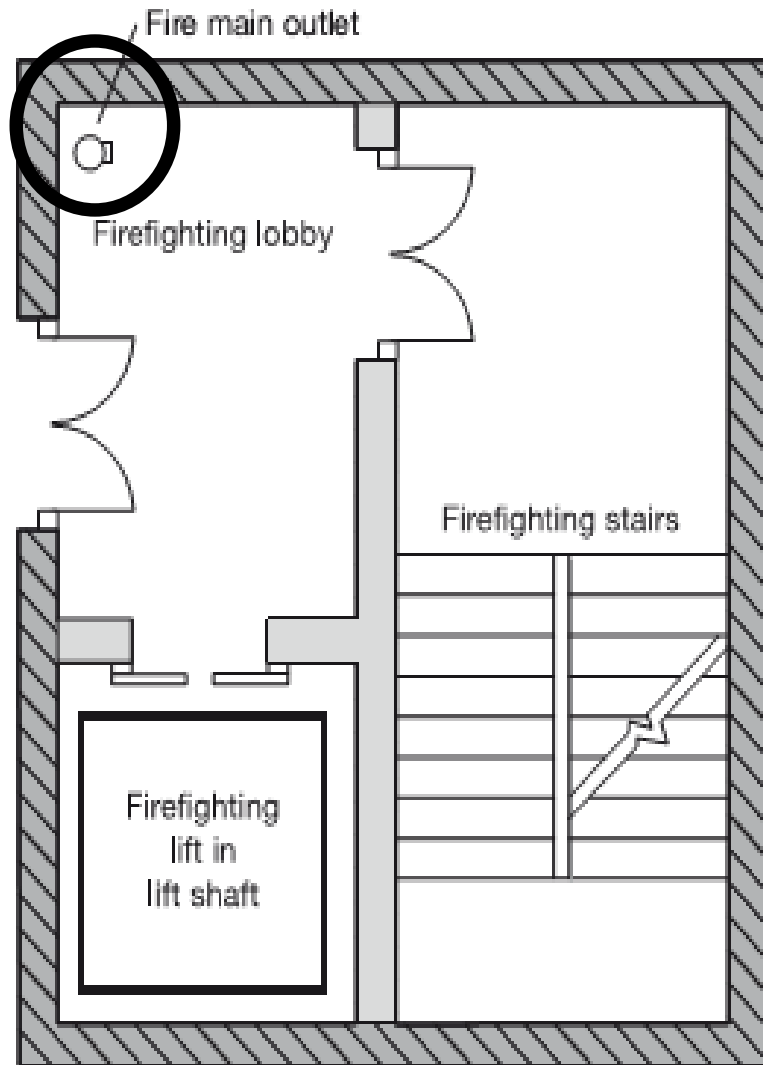
**And .... How would we manage it?**

**KFRS 'ICE' Training 2010**

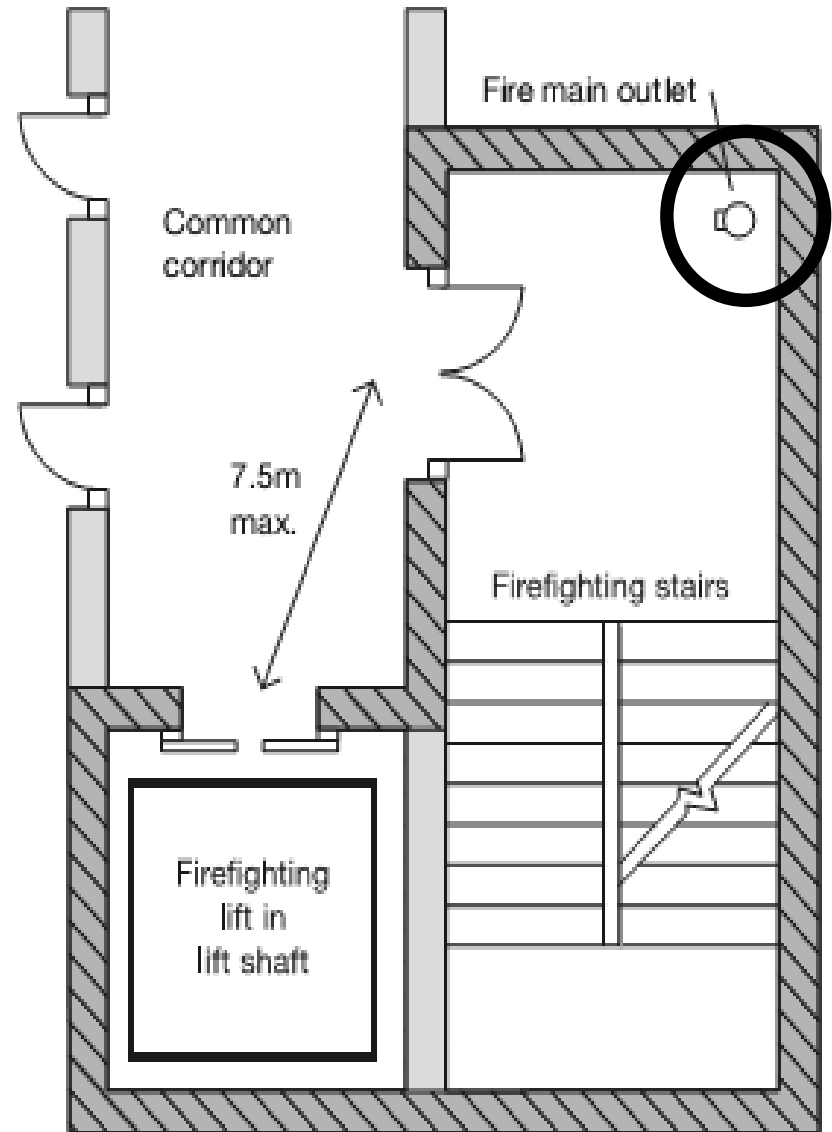
# Diagram 52 Components of a firefighting shaft

See para 17.1

a. Any building



b. Shafts serving flats







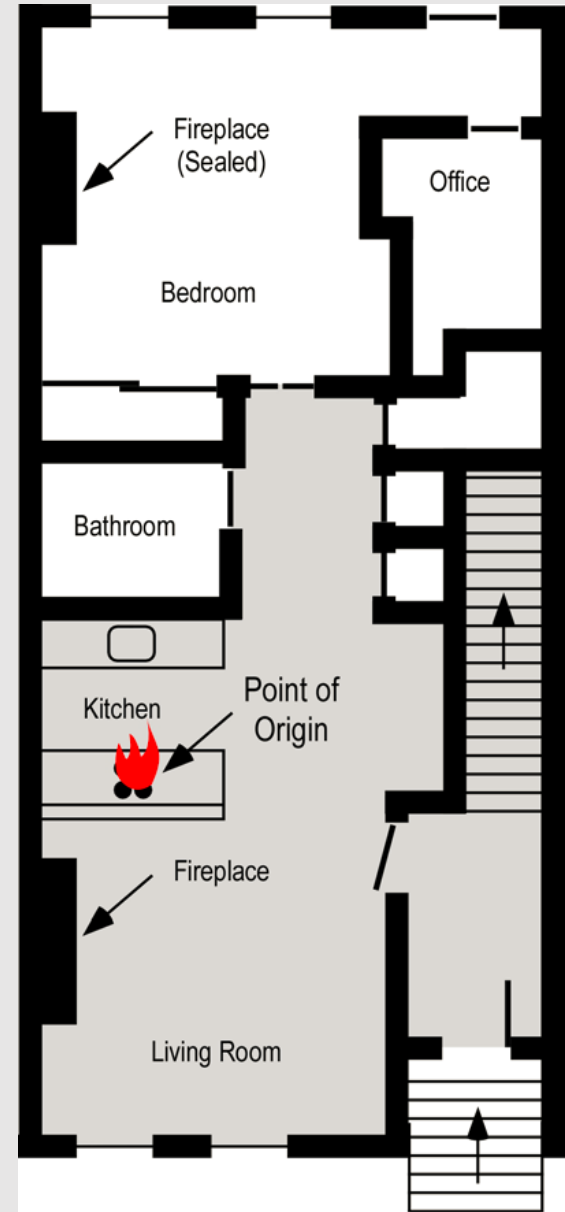


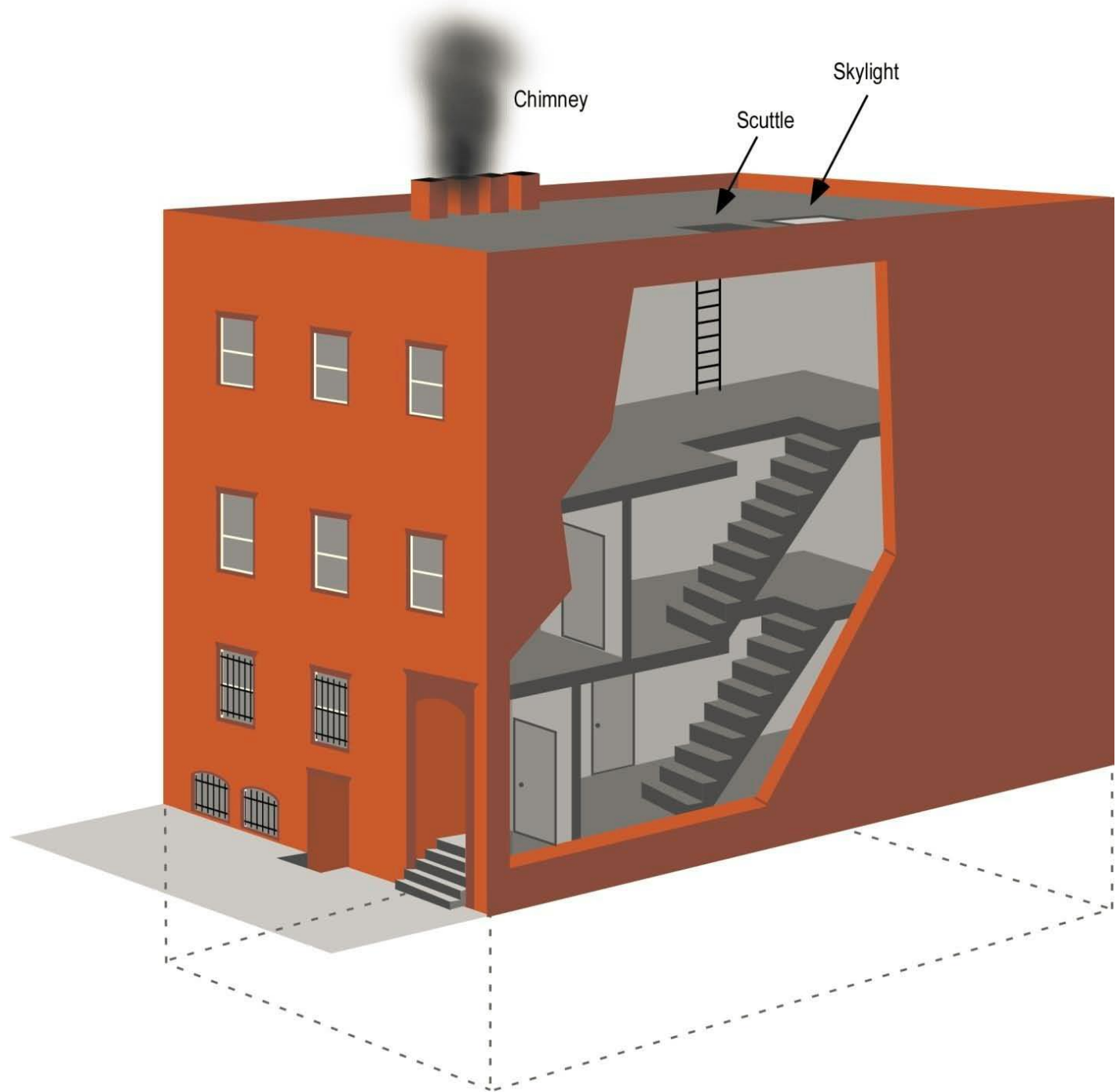
**A German fire chief once said that the most important room in a fire building is the stairwell! He is right. Stairwell protection is a critical strategy in a successful firefighting operation, in an occupied building involved in fire.**



**London 1987  
and 1994**

# Watts Street NYC 1994



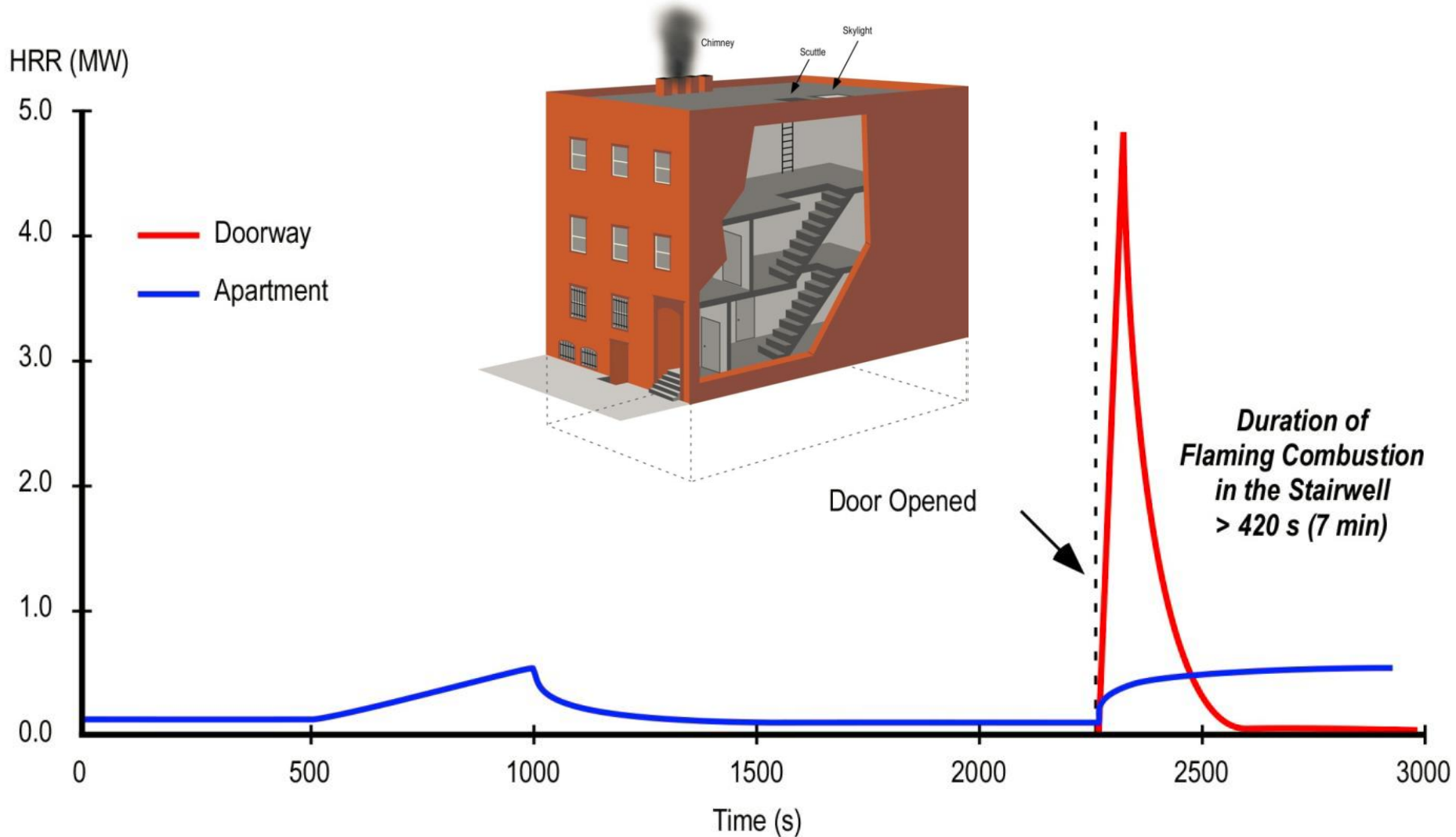


Chimney

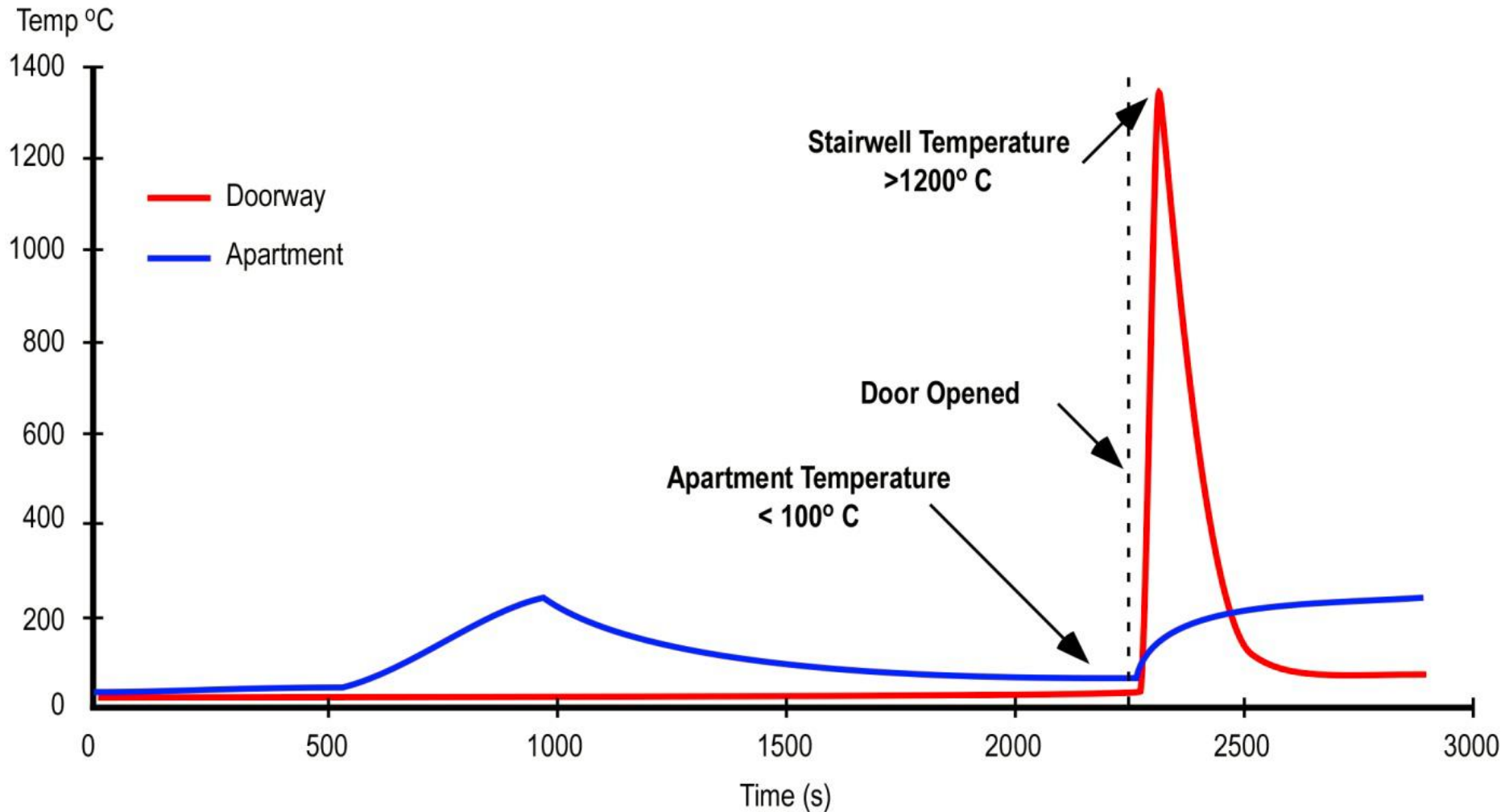
Scuttle

Skylight

# Heat Release Watts Street CFAST



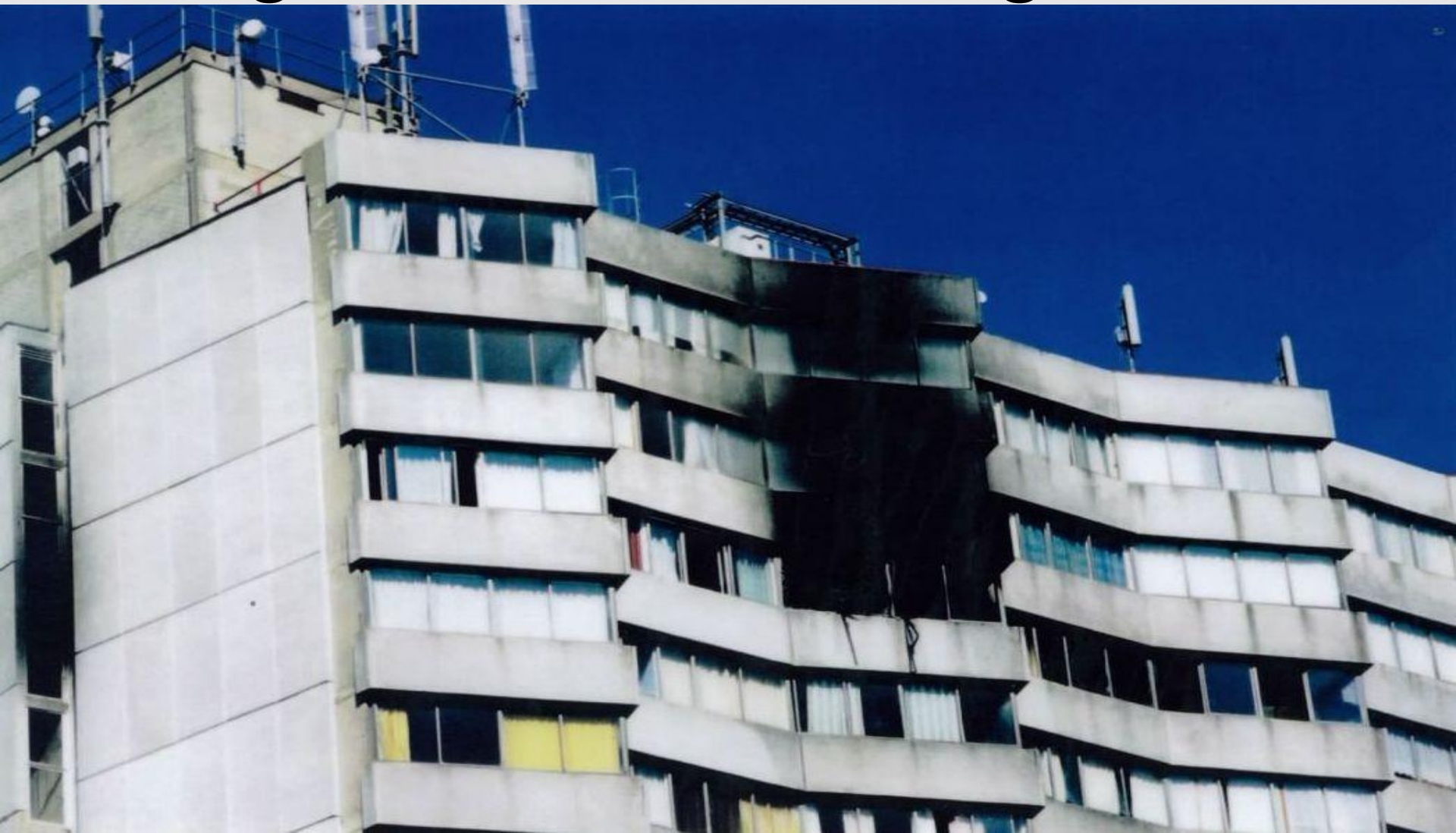
# Temperatures Watts Street CFAST



**3.3.29** of the **FDNY** New York City Fire Department Multiple Dwellings (residential high-rise) SOP:

**3.3.29:** *"The first line stretched for a fire in a multiple dwelling should be stretched by way of the interior stairs. The primary purpose of this line is to safeguard the stairway so that it can be used by the escaping occupants. **The door to the fire apartment must not be opened while people are coming down the stairway from the floors above.** When the safety of the stairway is assured, this first line may be advanced to extinguish the fire".*

# Arlington House Fire, Margate 2001





# Arlington House Fire, Margate 2001



# Arlington House Fire, Margate 2001



# Staner Court, Ramsgate Fire 2001



# Staner Court, Ramsgate



# Lakanal House Fire London 2009



## *National Fire Chiefs Council (NFCC) UK*

*'Following the extraordinary events of June last year it was realised that this was not a scenario that had been planned for (firefighting Ops)'*





*National Fire Chiefs Council (NFCC) UK*

*‘the vast majority of Fire Services, if not all outside London, could not cope with a Grenfell type incident, even with mutual aid’*







## Dijon, France 2010

Seven people have been killed and 11 seriously injured by a fire in a nine-storey hostel housing immigrants in the eastern French city of Dijon. One person died after jumping from the seventh floor of the building, while the other six died from the effects of smoke inhalation.

More than 130 people were evacuated from the building, many also suffering from smoke inhalation.

An investigation into the cause of blaze has been launched.

Spread rapidly

Two of the dead were from Senegal, one was Algerian and another Vietnamese. The other three were French nationals.



# 2010 KFRS High-rise Training



The training was delivered over a thirteen month period May 2010 to June 2011 where 97 officers were trained across nine seminars. There were also attendances from other UK fire service instructors as well as an officer from the German fire service.

# 2010 KFRS High-rise Training



‘The guidance in our national high-rise procedure had encouraged a strong preference towards ‘intervention’ (interior attack) as the primary objective and then encompassed other tactical options (like evacuation) as secondary alternatives, but failed to offer any guidance as to how alternative objectives could be effectively prioritized or achieved’.

# Information Overload?



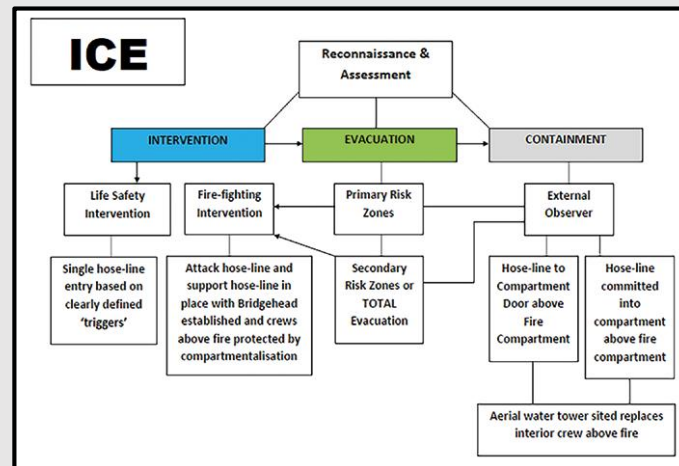
# 2010 KFRS High-rise Training



‘During the initial two seminars it was realized that in many training simulations the **task objectives** were not being prioritized effectively due to a clear preference for immediate attack.

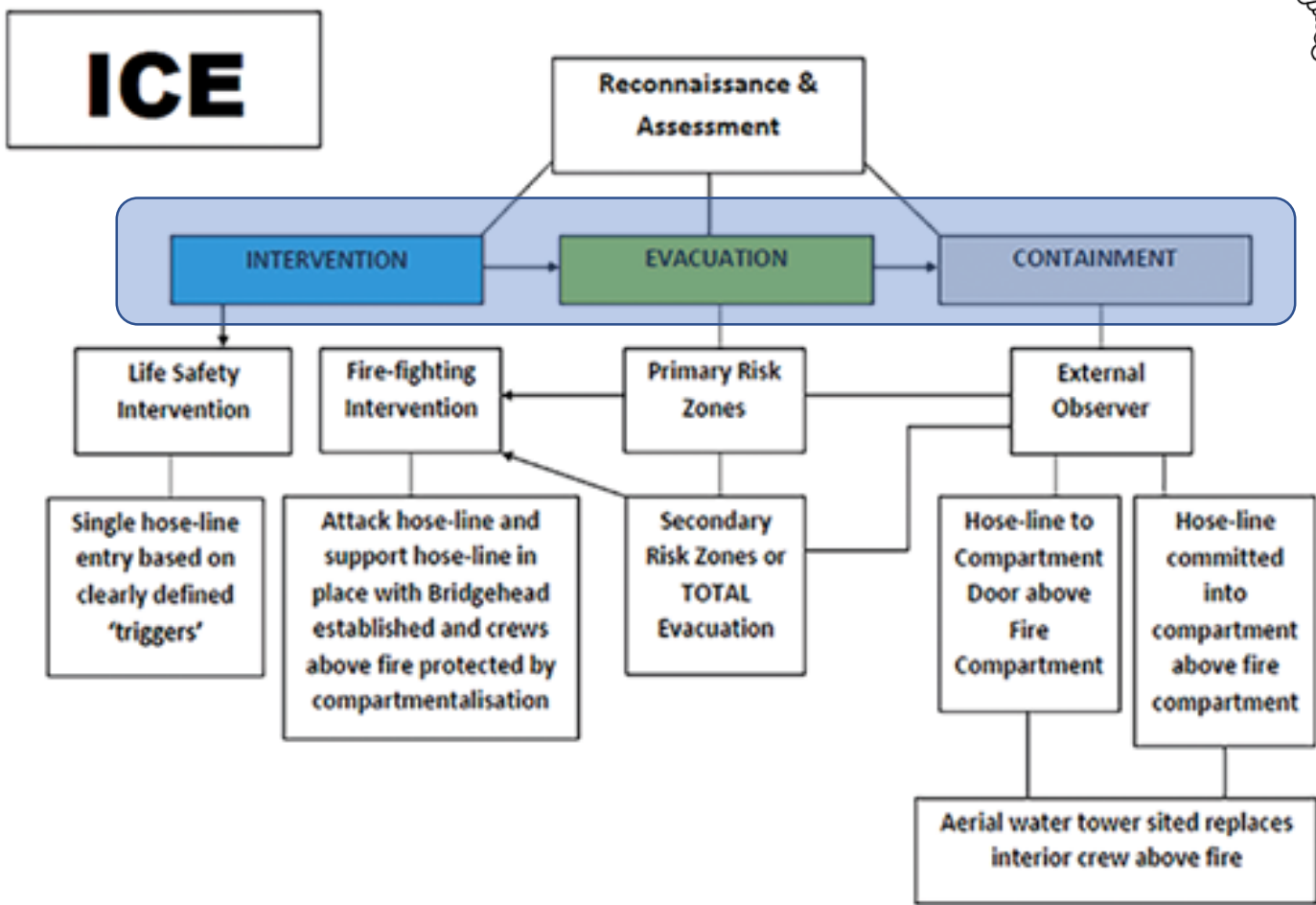
Therefore a new approach was developed for the remaining seven seminars that placed greater emphasis on **prioritizing tactical objectives** and managing ongoing operations’.

In 2010 the I.C.E. high-rise rapid Decision Model was introduced to Kent Fire and Rescue fire commanders during a series of Fire Studio table top seminars, where a real time external wall fire was simulated.





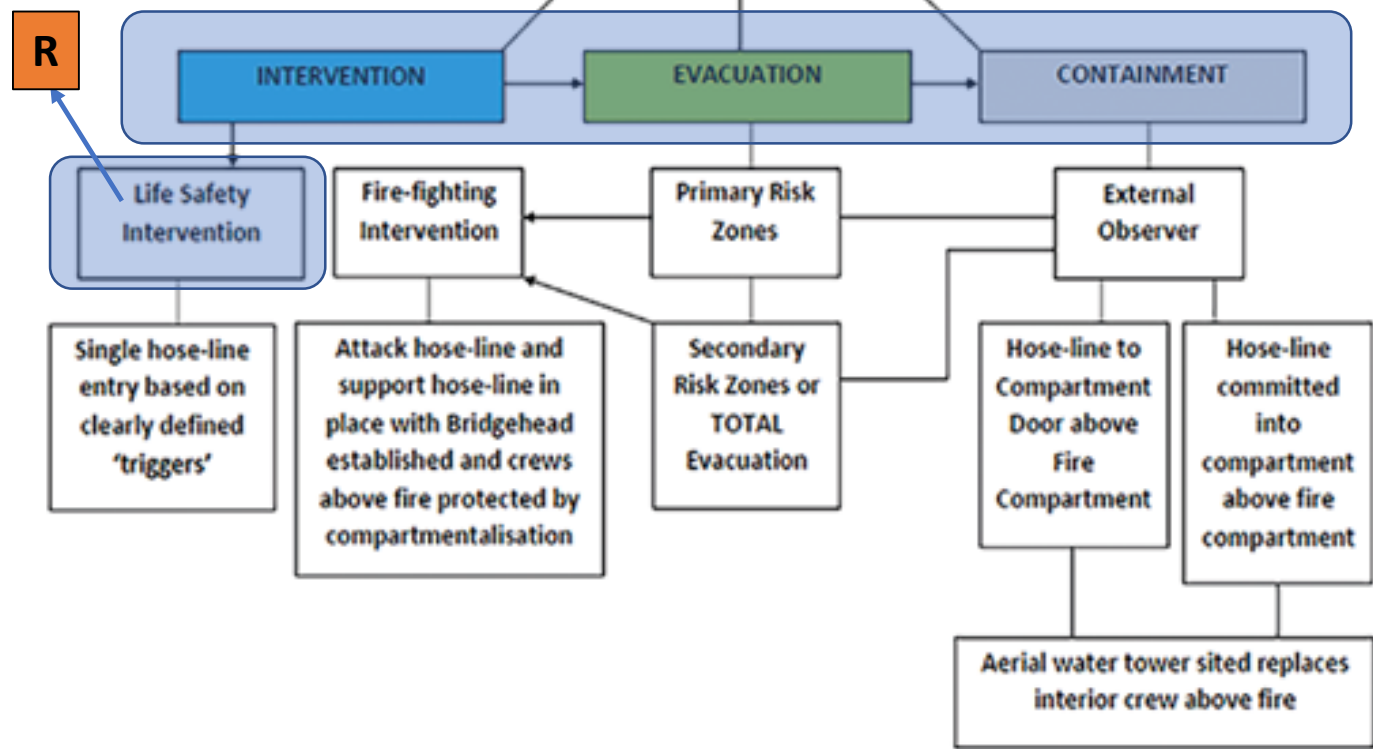
# ICE







# R ICE





“The overriding objective is to maintain vertical escape routes for occupants clear of smoke”.....

**KFRS 'ICE' Training 2010**



‘In situations where single exit stairs may become compromised by smoke as firefighters open up the fire compartment, the evacuation of the entire building above the fire floor, and possibly below it, may need to be controlled’.

**KFRS ‘ICE’ Training 2010**





# Stairwell Protection Teams

# National High-rise Firefighting Guidance

In circumstances where teams need to work in an area above the bridgehead which is not affected by fire or smoke and the Incident Commander has confirmed that the building's construction and any fire engineered solutions have not been compromised, **teams can be committed without respiratory protective equipment.**

These teams must **maintain communication** and a **Safety Officer** must be deployed in the stairwell and be **in contact** with other Safety Officers and the Incident Commander outside the building.

# External Wall – Fire Spread



- Typical window to window limited vertical fire spread
- Combustible window sets ground to roof
- External ACM or MCM wall cladding rain-screens over combustible insulation
- External rendered wall systems over insulation
- Glass curtain walls
- Combustible Balconies with high hazard storage included in some cases

# Combustible Window Sets

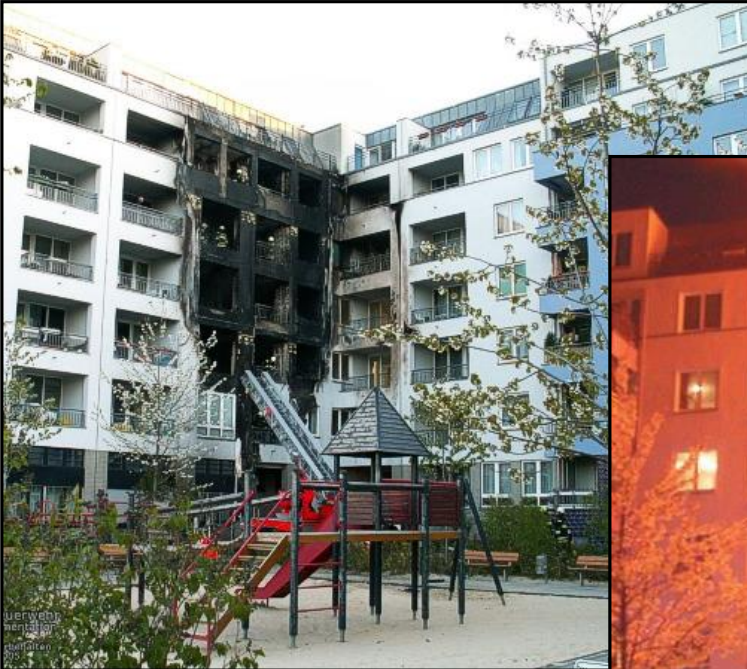




# Combustible Window Sets

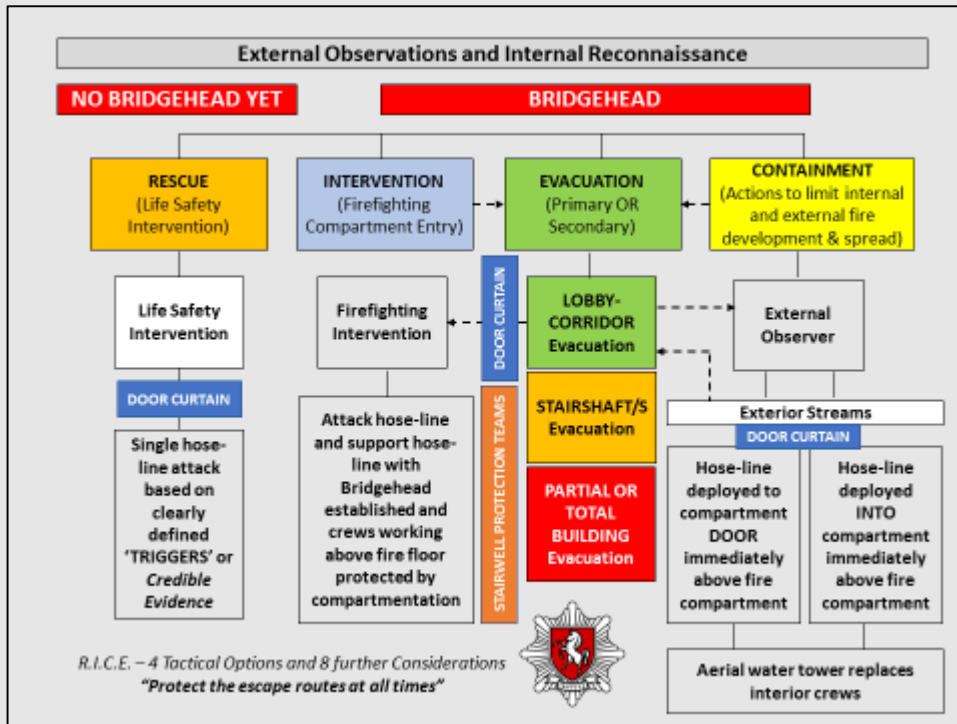


# Combustible External Walls





# R.I.C.E Tactical Decision Tool



# External Observations and Internal Reconnaissance



**RESCUE**  
(Life Safety  
Intervention)



**INTERVENTION**  
(Firefighting  
Compartment Entry)



**CONTAINMENT**  
(Actions to limit internal  
and external fire  
development & spread)

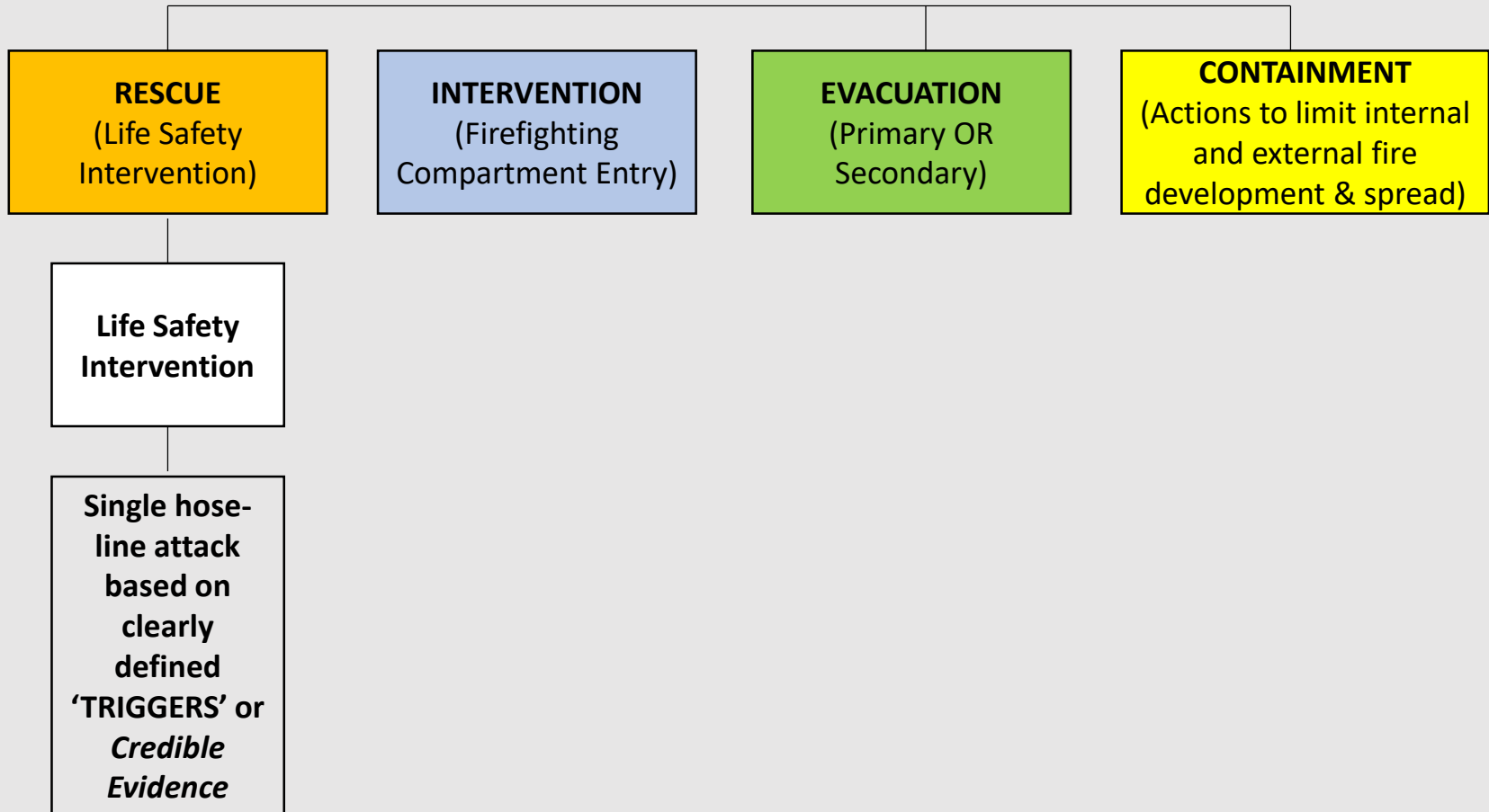


**EVACUATION**  
(Primary OR  
Secondary)



# External Observations and Internal Reconnaissance

**NO BRIDGEHEAD YET**



# External Observations and Internal Reconnaissance

## BRIDGEHEAD

**RESCUE**  
(Life Safety  
Intervention)

**Life Safety  
Intervention**

**Single hose-  
line attack  
based on  
clearly  
defined  
'TRIGGERS' or  
*Credible  
Evidence***

**INTERVENTION**  
(Firefighting  
Compartment Entry)

**Firefighting  
Intervention**

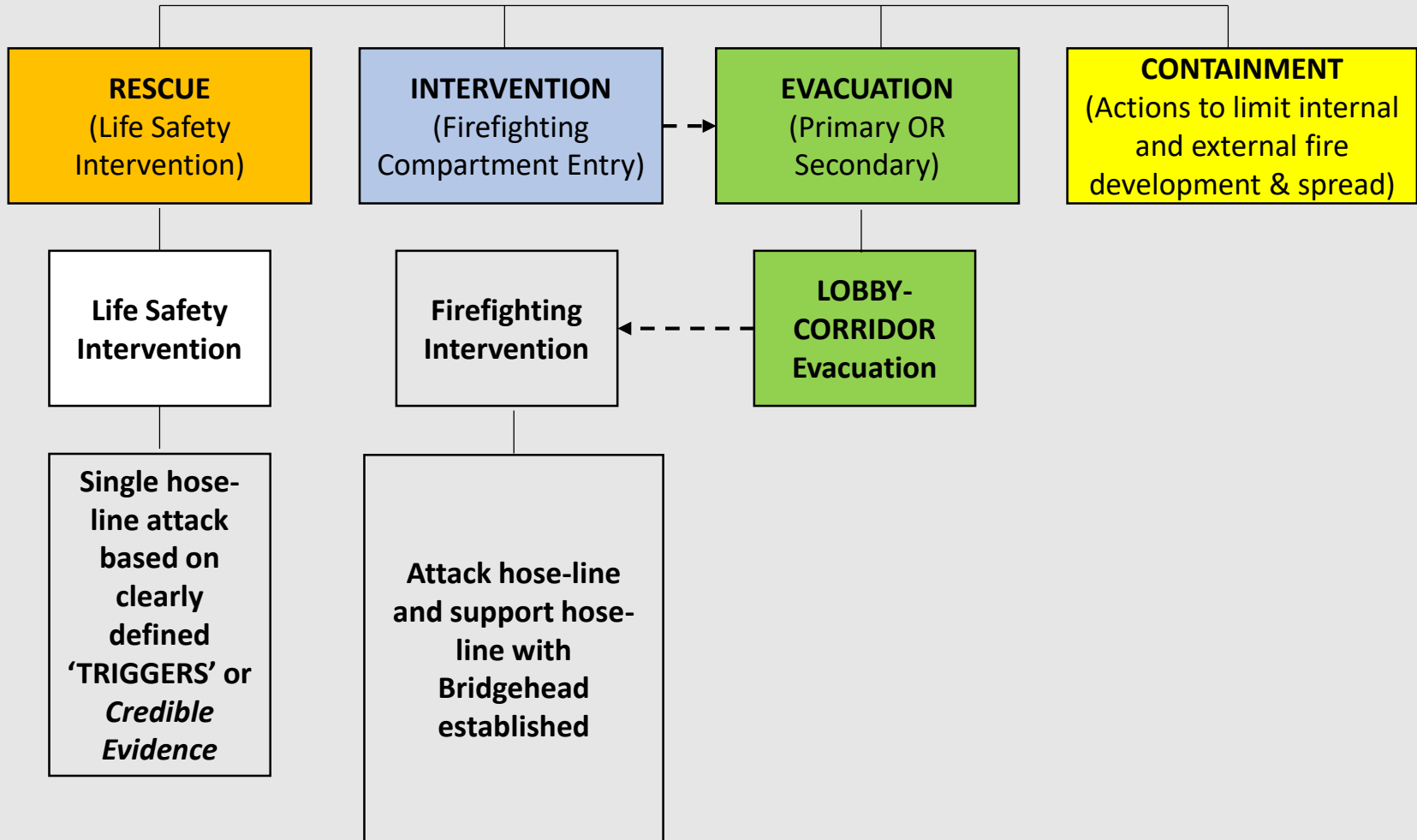
**Attack hose-line  
and support hose-  
line with  
Bridgehead  
established**

**EVACUATION**  
(Primary OR  
Secondary)

**CONTAINMENT**  
(Actions to limit internal  
and external fire  
development & spread)

# External Observations and Internal Reconnaissance

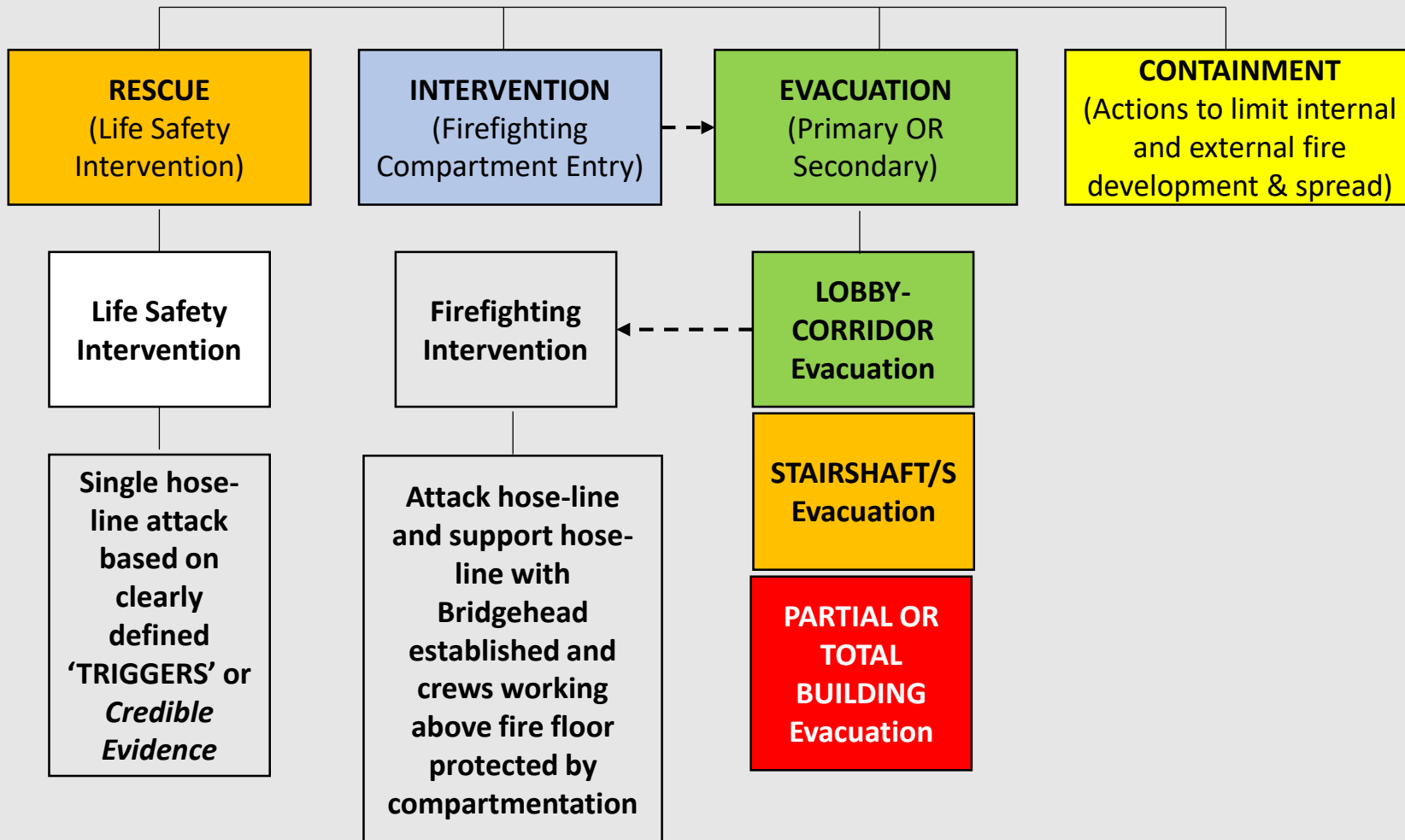
## BRIDGEHEAD





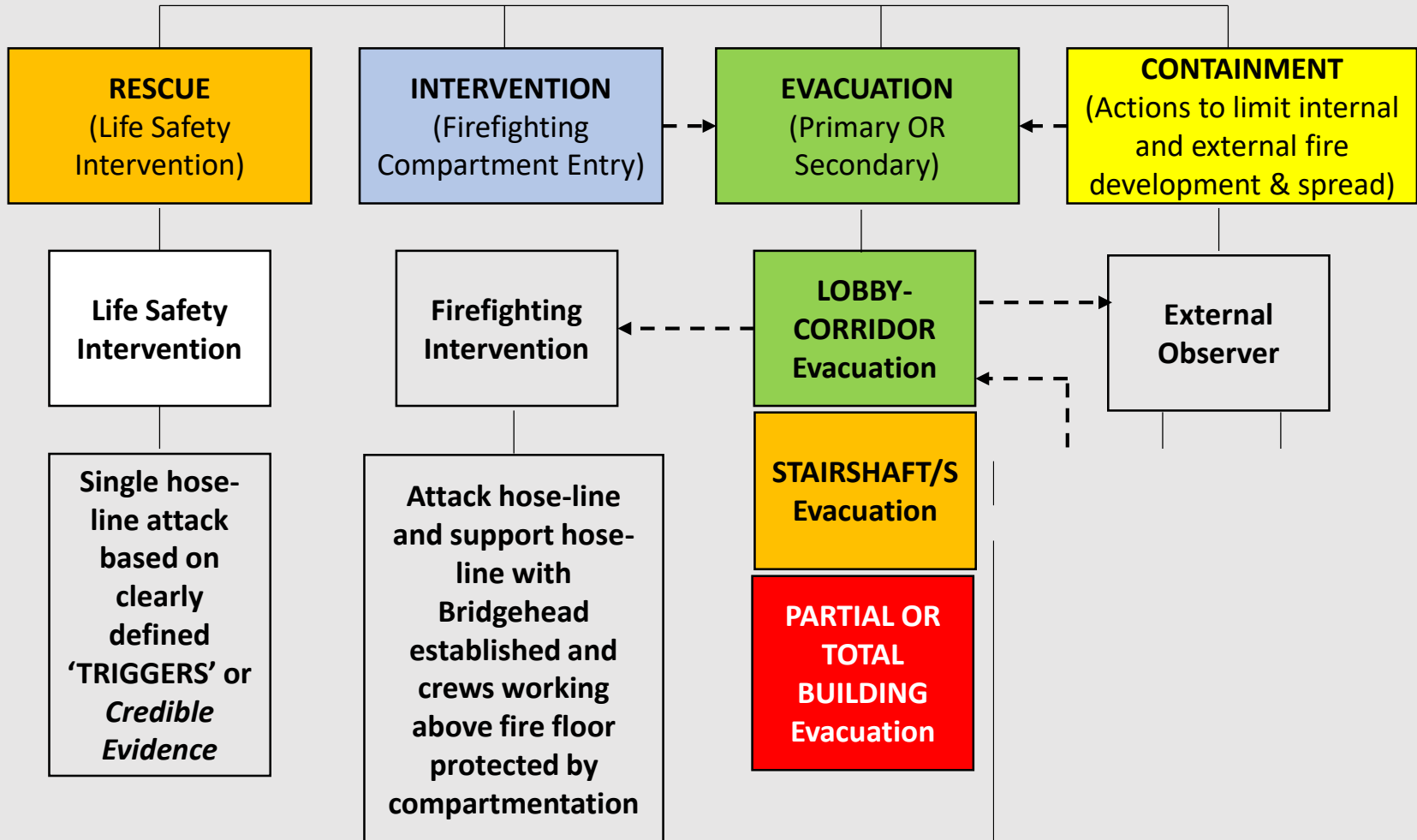
# External Observations and Internal Reconnaissance

## BRIDGEHEAD



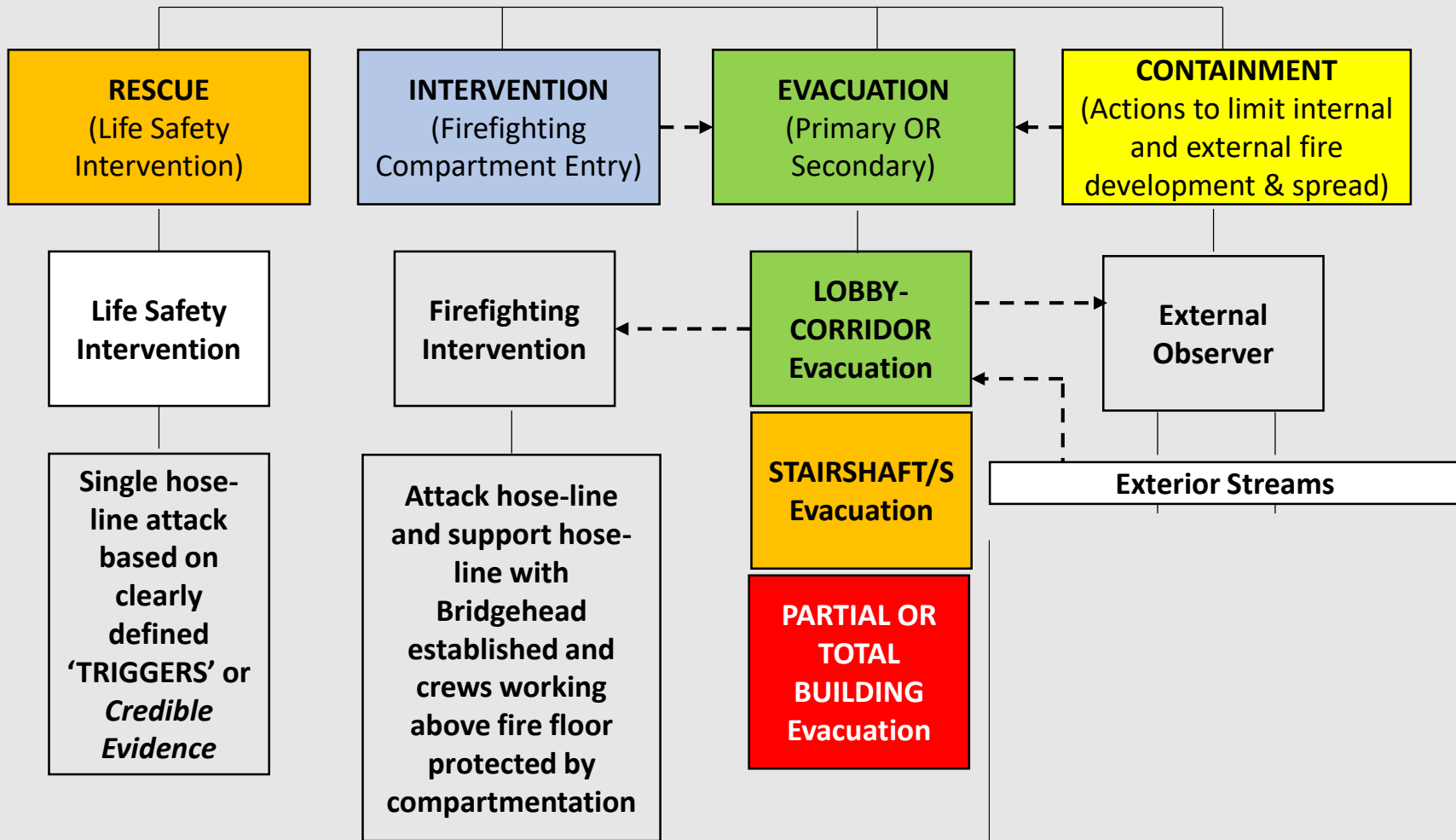
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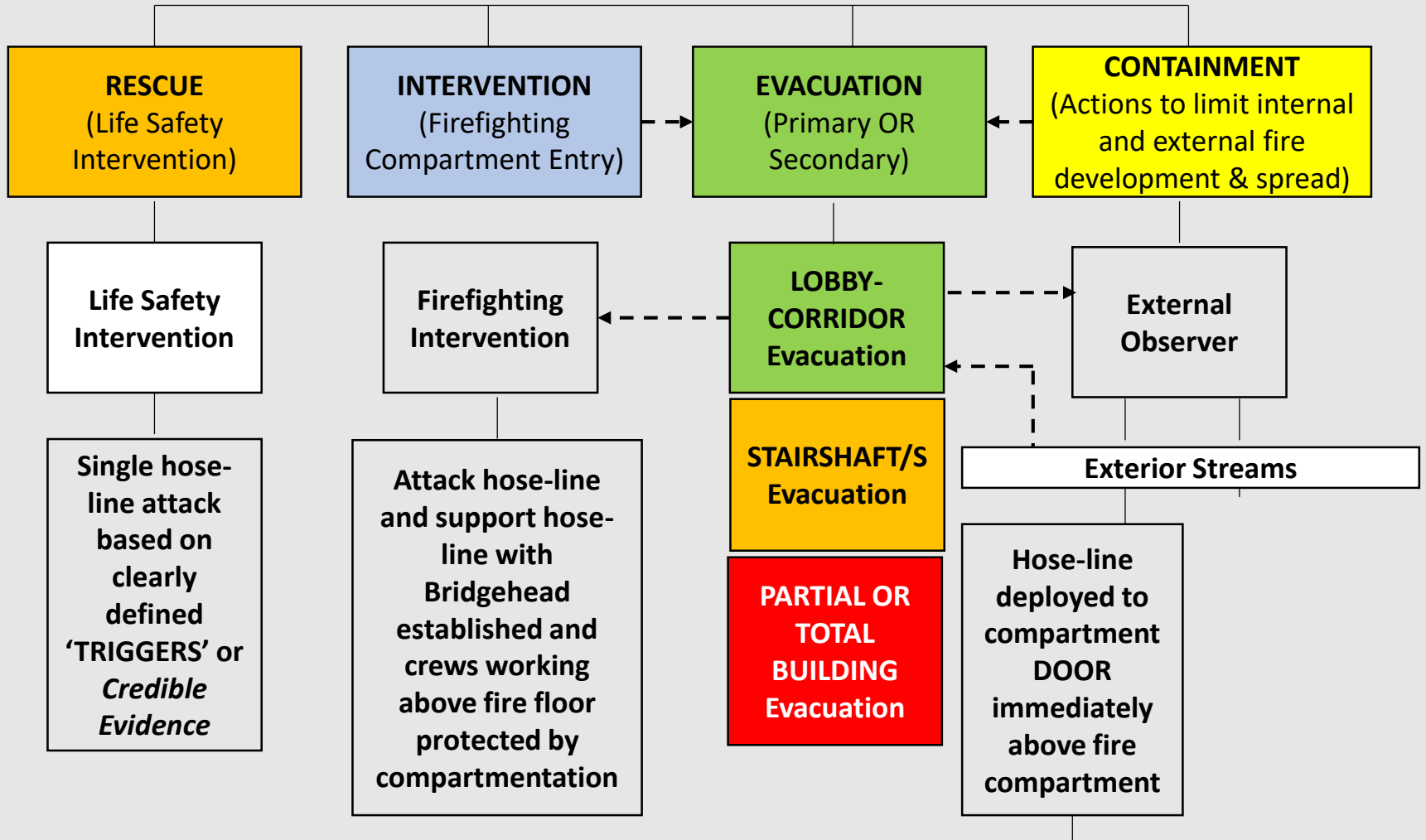
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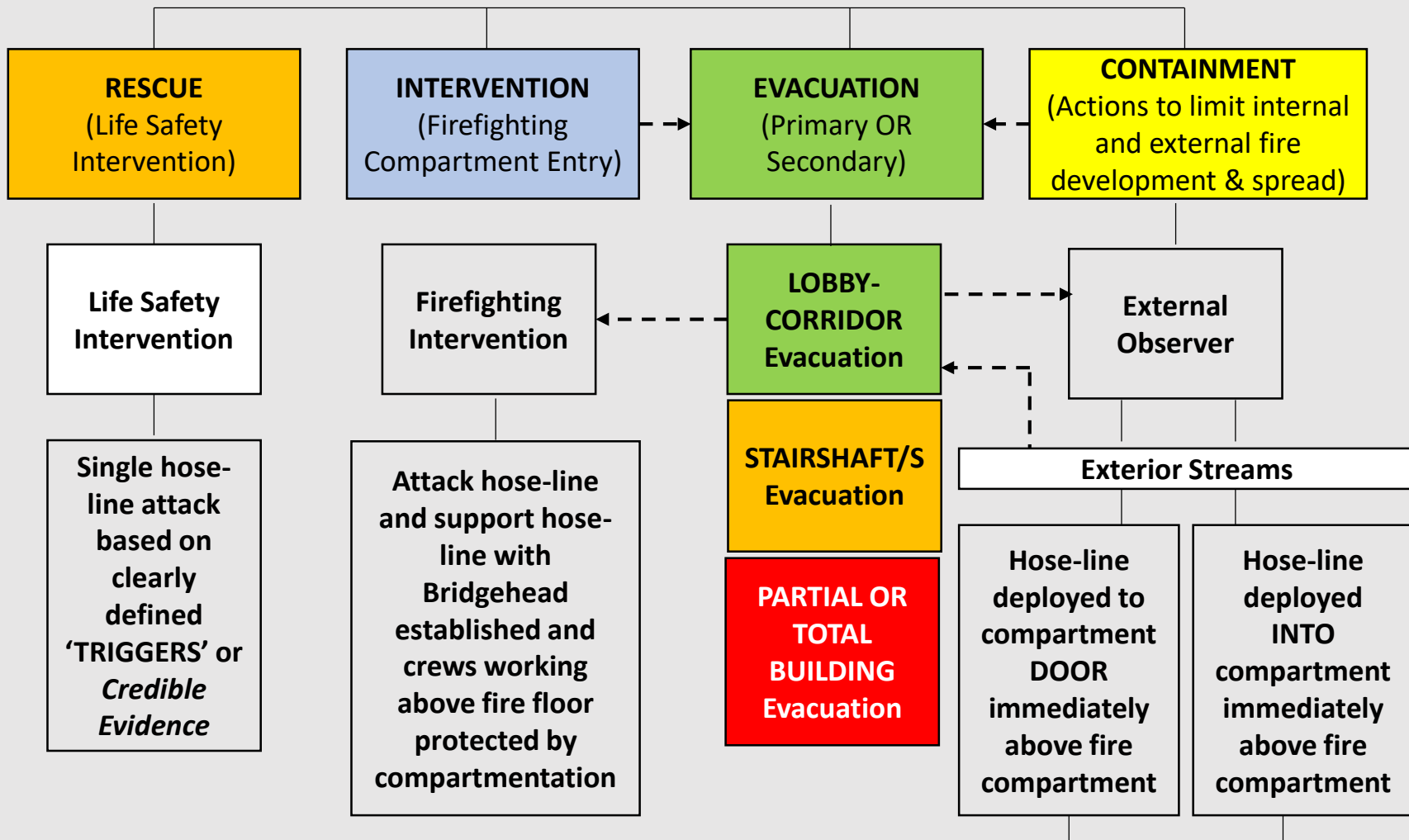
# External Observations and Internal Reconnaissance

## BRIDGEHEAD



# External Observations and Internal Reconnaissance

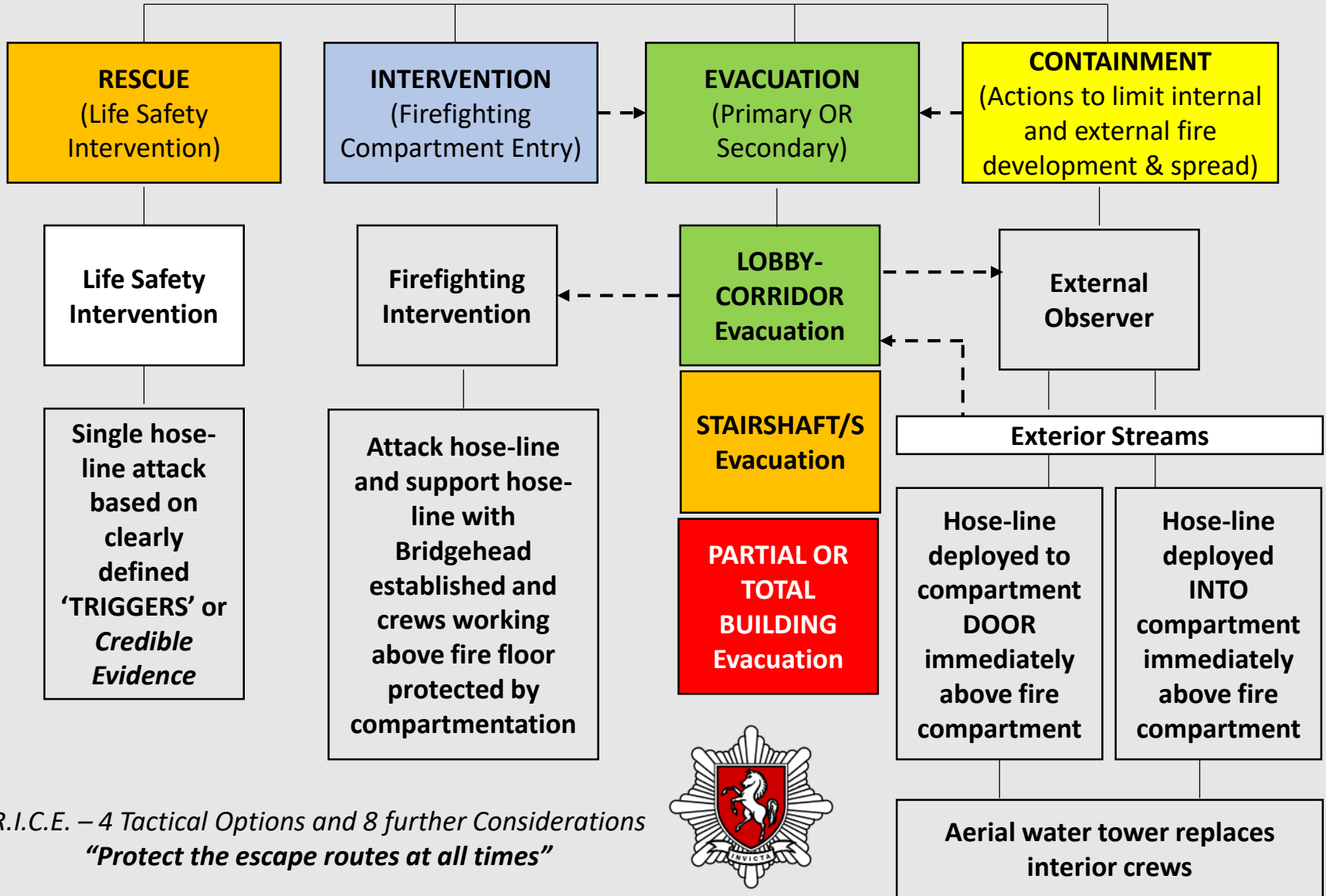
## BRIDGEHEAD



# External Observations and Internal Reconnaissance

**NO BRIDGEHEAD YET**

**BRIDGEHEAD**



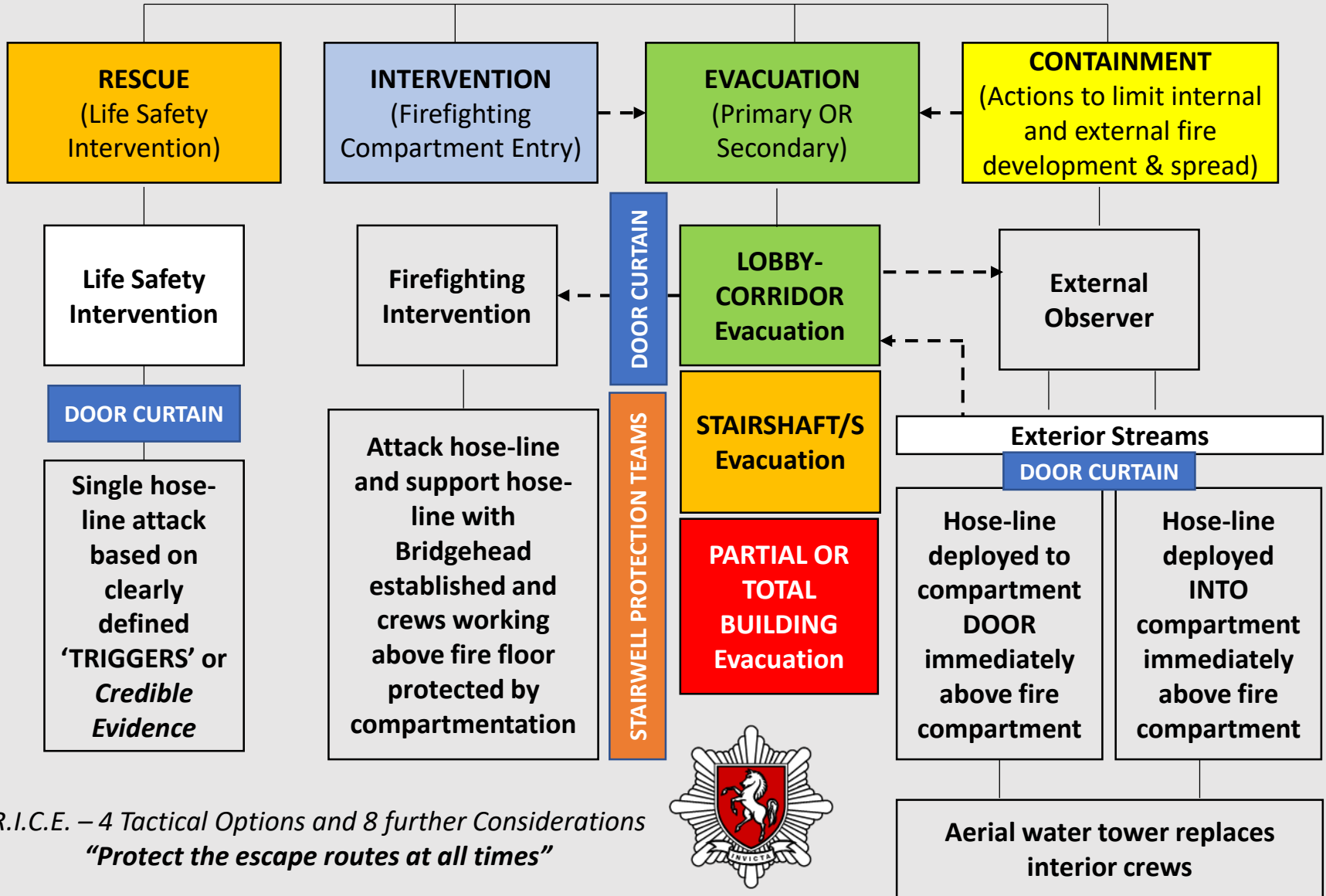
R.I.C.E. – 4 Tactical Options and 8 further Considerations  
*“Protect the escape routes at all times”*



# External Observations and Internal Reconnaissance

**NO BRIDGEHEAD YET**

**BRIDGEHEAD**



R.I.C.E. – 4 Tactical Options and 8 further Considerations  
 “Protect the escape routes at all times”



# Failing Design Factors

At what point is the 'fire safety design' of a residential building failing?

- Internal failure of compartmentation – 60 minute 'boxes' 30 minute escape routes
- Failure of smoke control systems
- Failure of firefighting lifts or water stairwells, risers
- **External fire spread beyond two storeys (three storeys)**







‘Is it our role to evacuate, or to maintain egress routes to assist occupants in self evacuation’?

# Evacuation of 20 storey Building

## 80 to 240 Flats or Apartments



- 20s per person/floor
- Add movement times along corridors
- 0.33 m<sup>2</sup>/person
- Single file 1.1m width
- 10-15 mins to street
- Firefighters ascending
- **Add pre-movement time**



Realistic minimum times of evacuation of >40-60 mins (**in tenable conditions and of average age and fitness**)



“the principles of the ***Stay Put*** regime can be considered to have *started to fail* by **01:15** (time fire spread to Level 5), and to have *substantially failed* by **01:26** (fire had spread to Level 23)”.

**Barbara Lane**

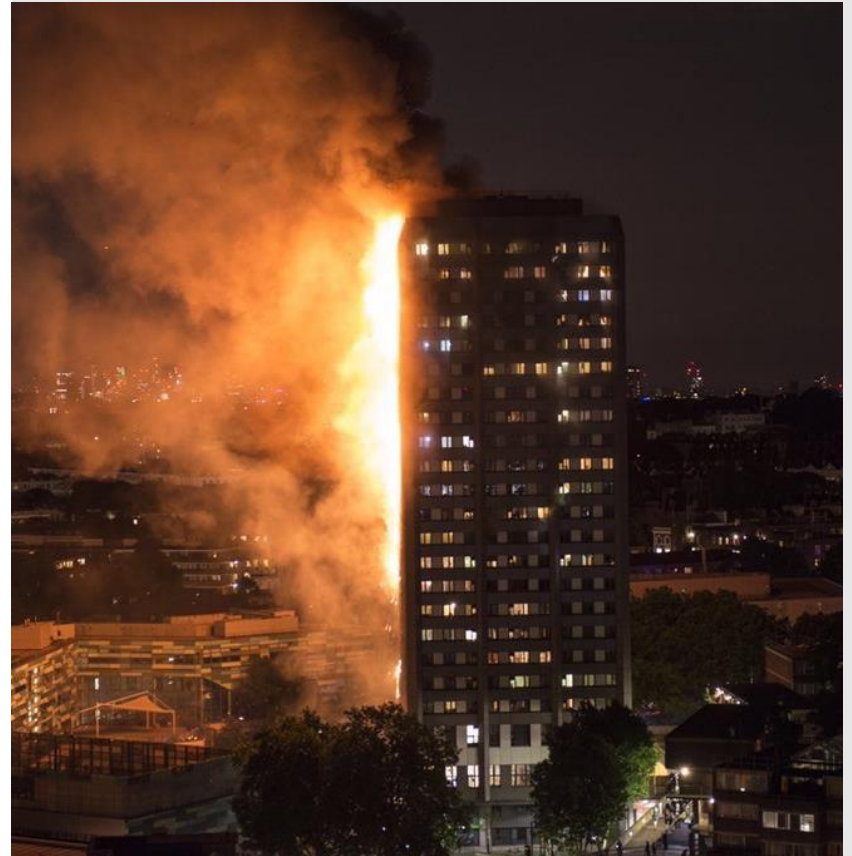
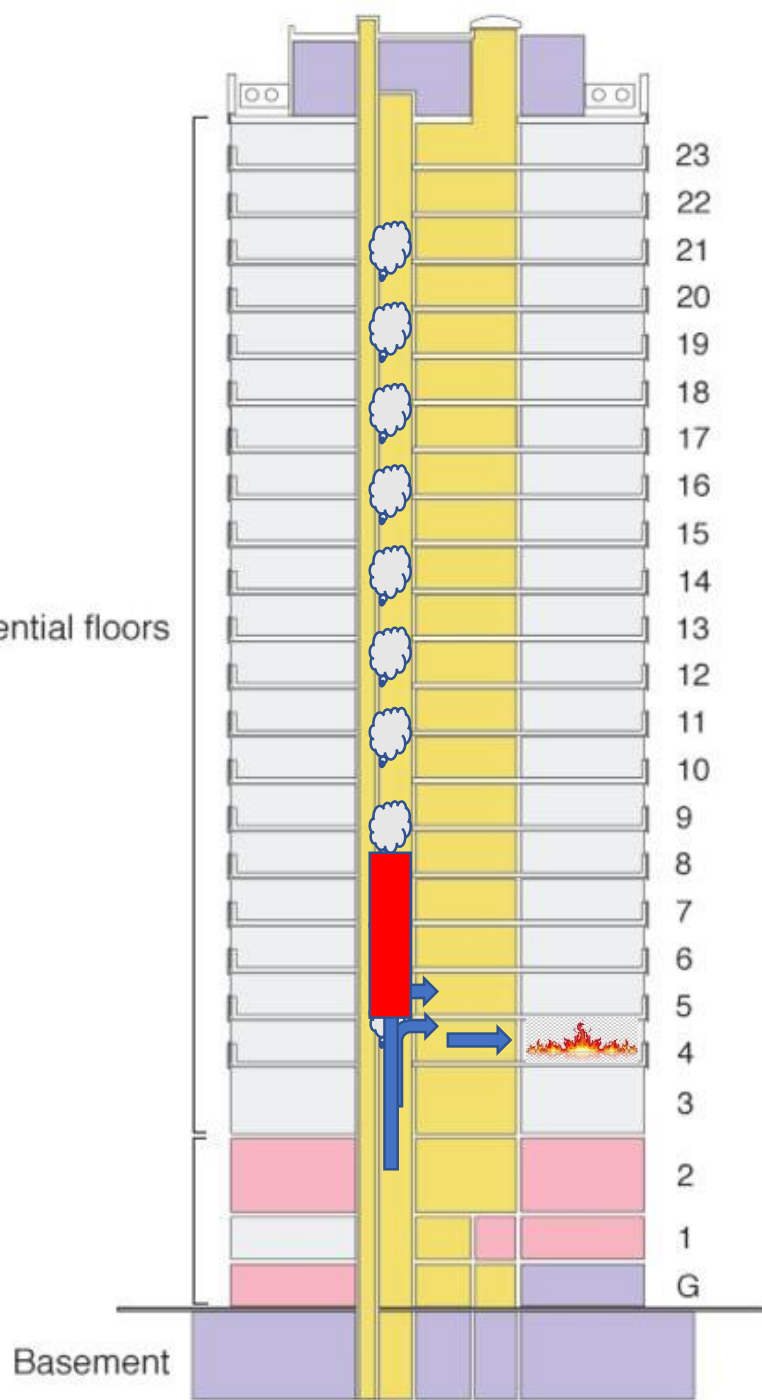


**01:28** 'Firefighters enter flat  
26 on the fifth floor'

## **London Fire Brigade**

'The smoke is thick, black and down to the ground. The lift lobby then fills full of smoke which then goes into the stairwell as the fire hose is propping the lift lobby door open'.

Residential floors



01.38





‘Between 01:19 and **01:38**, the largest number of evacuations occurred (110) (**5.5 people/minute**).

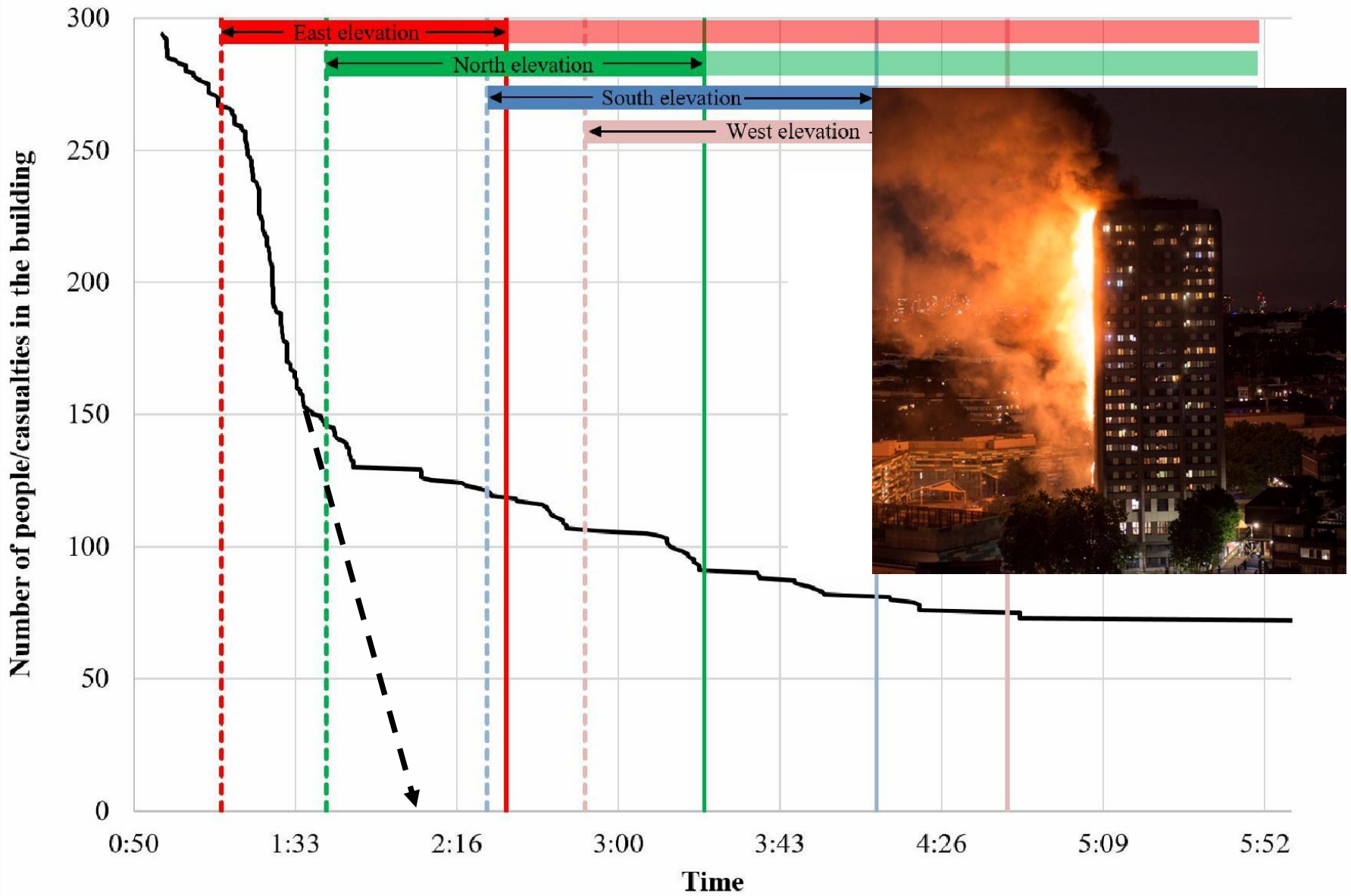
From my investigation, the fire service witness statements describe the stairs as being free of smoke at this time.

Residents of every floor escaped during this time, except Levels 4, 22 and 23’.



‘At 01:40 there were still 151 residents inside the building. At this time the fire was spreading in two separate flame fronts along the East elevation and had also reached and involved the North elevation. A total of 144 persons had evacuated the building by 01:38, that is 40 minutes after the initial fire’.

# Fire spread around building envelope

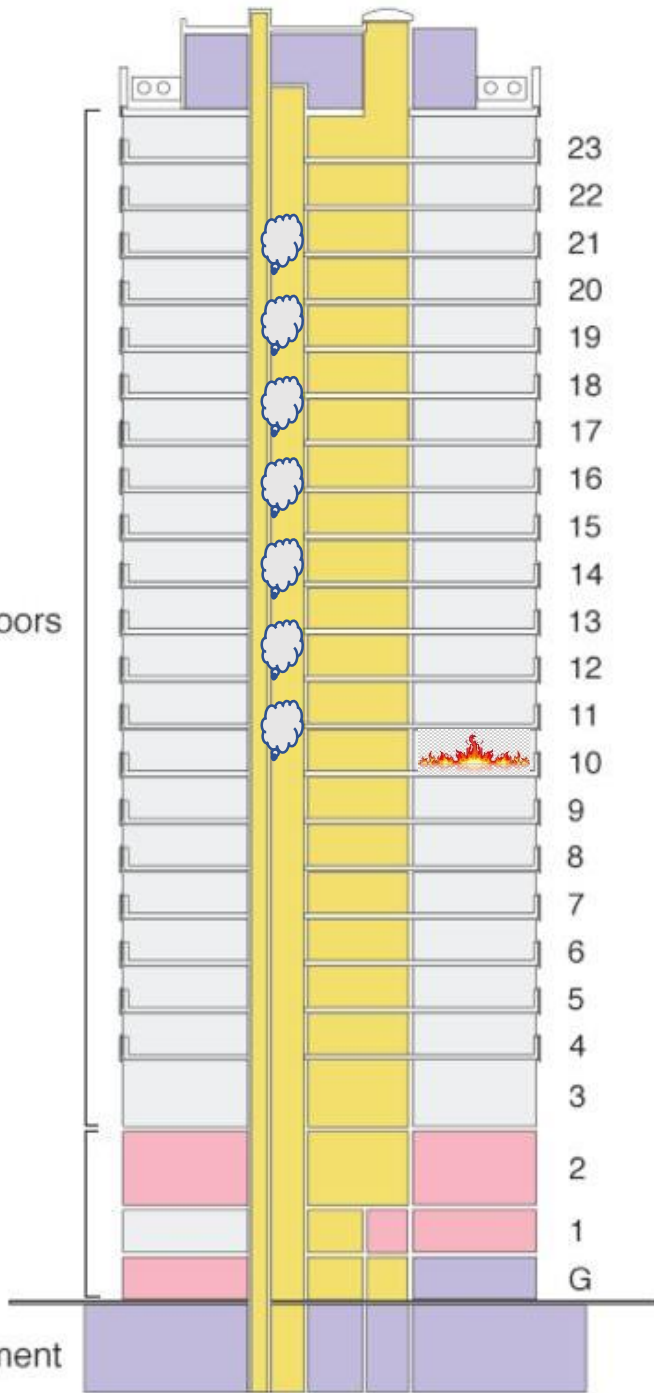






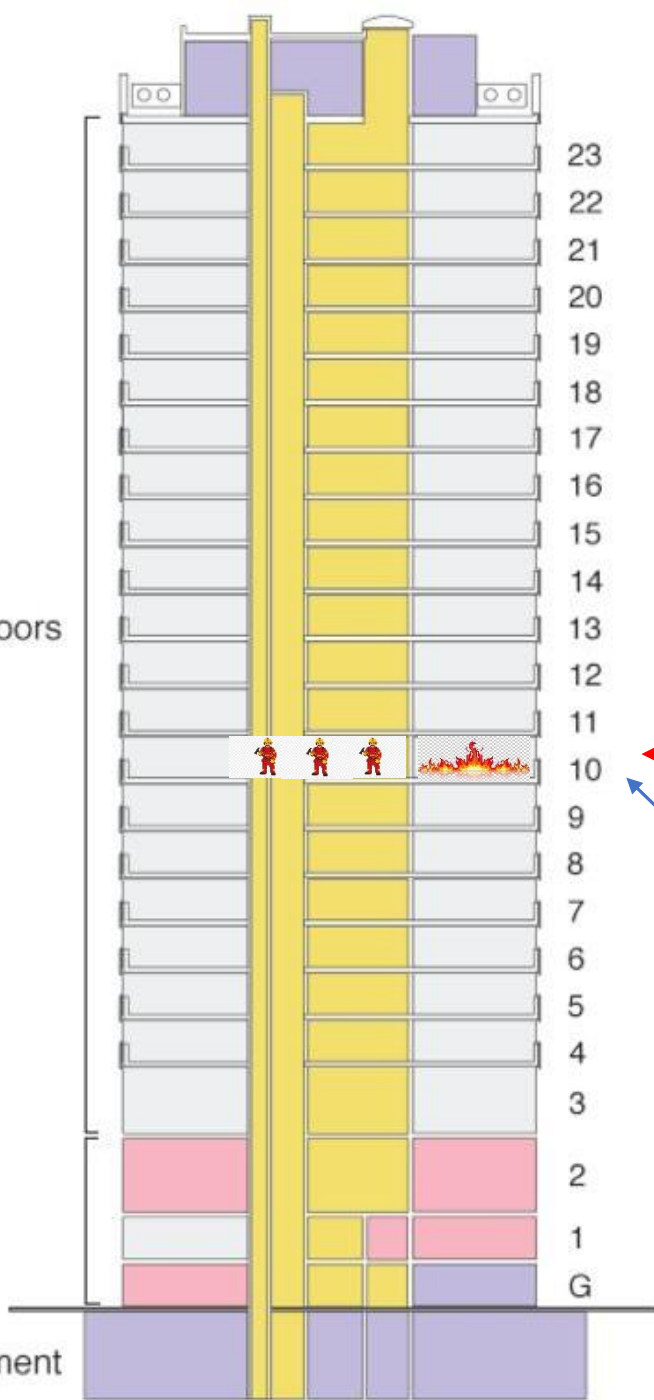
Residential floors

Basement



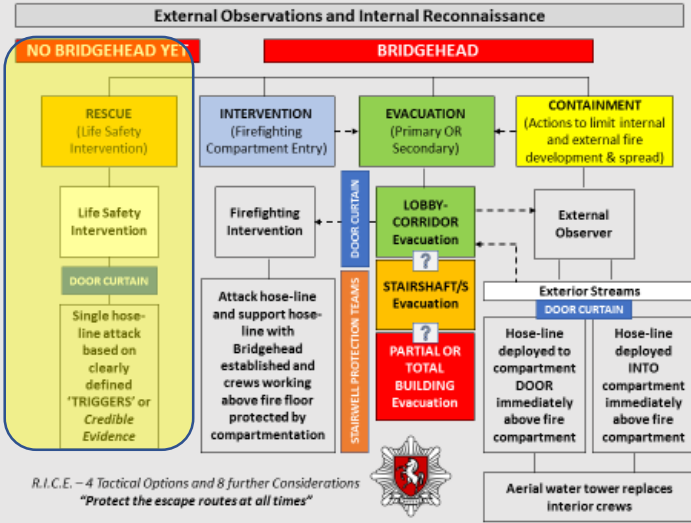
Residential floors

Basement



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# R.I.C.E

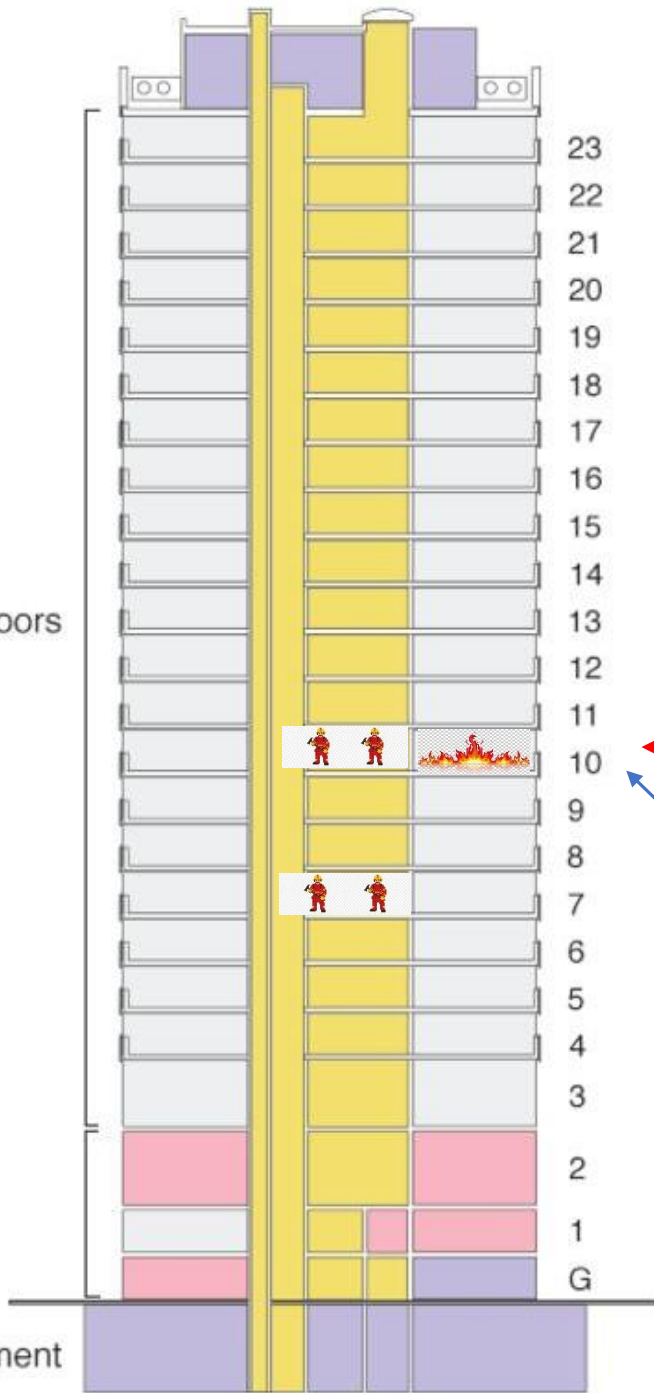


Fire Floor

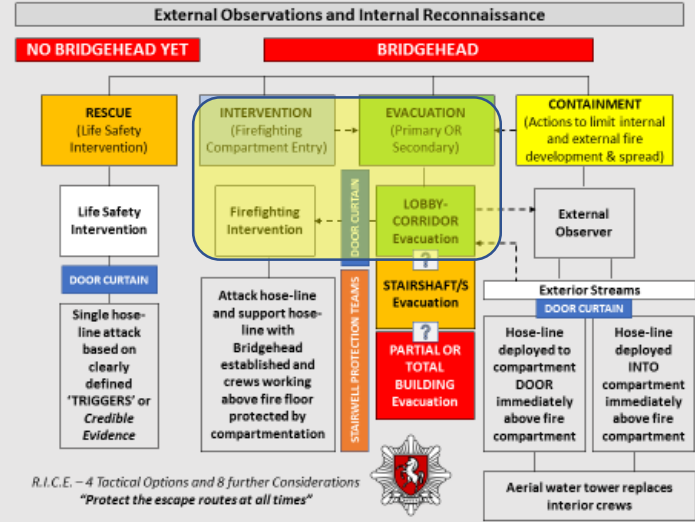


Residential floors

Basement



# R.I.C.E



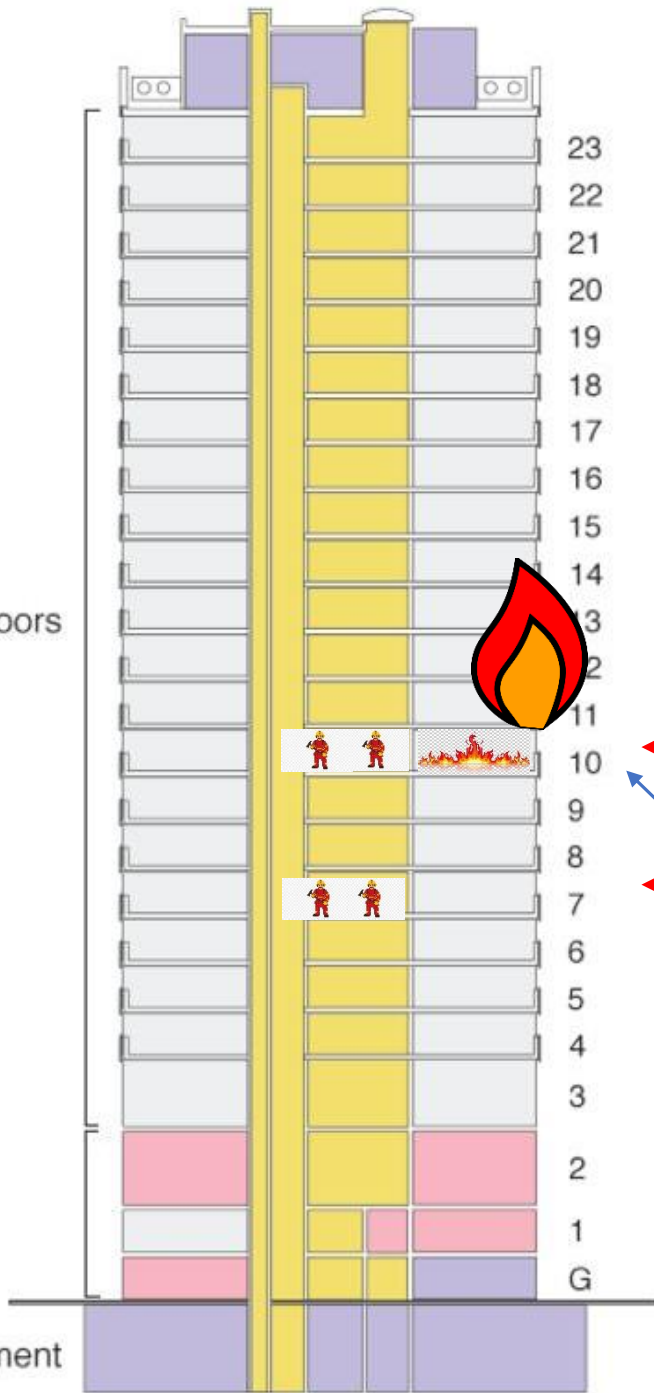
Fire Floor

Bridgehead

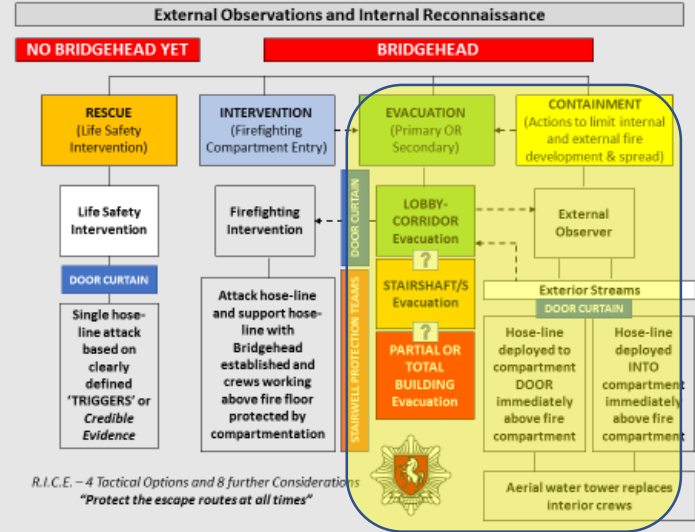


Residential floors

Basement



# R.I.C.E



Fire Floor

Bridgehead



# Roles of 'Stairway Protection Teams'

- **Patrol** stairwells continuously from top-to-bottom to ensure that egress routes are safe and free of obstructions; monitor gas levels
- **Search** floors, stairwells, hallways, and lifts for building occupants who may be trapped or are entering an untenable environment
- **Report** information about conditions at each floor to the incident commander.
- Ensure the stairs are **clear of smoke**
- **Deploy to FSG calls** where required
- **Manage occupant evacuation** where required





### Acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 min	30 min	60 min	4 hours	8 hours
<b>AEGL-1*</b>	NR	NR	NR	NR	NR
<b>AEGL-2<sup>†</sup></b>	420	150	83	33	27
<b>AEGL-3<sup>‡</sup></b>	1,700	600	330	150	130

## Carbon Monoxide

### Acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 min	30 min	60 min	4 hours	8 hours
<b>AEGL-1*</b>	2.5	2.5	2.0	1.3	1.0
<b>AEGL-2<sup>†</sup></b>	17	10	7.1	3.5	2.5
<b>AEGL-3<sup>‡</sup></b>	27	21	15	8.6	6.6

## Hydrogen Cyanide

# Roles of 'Stairway Protection Teams'

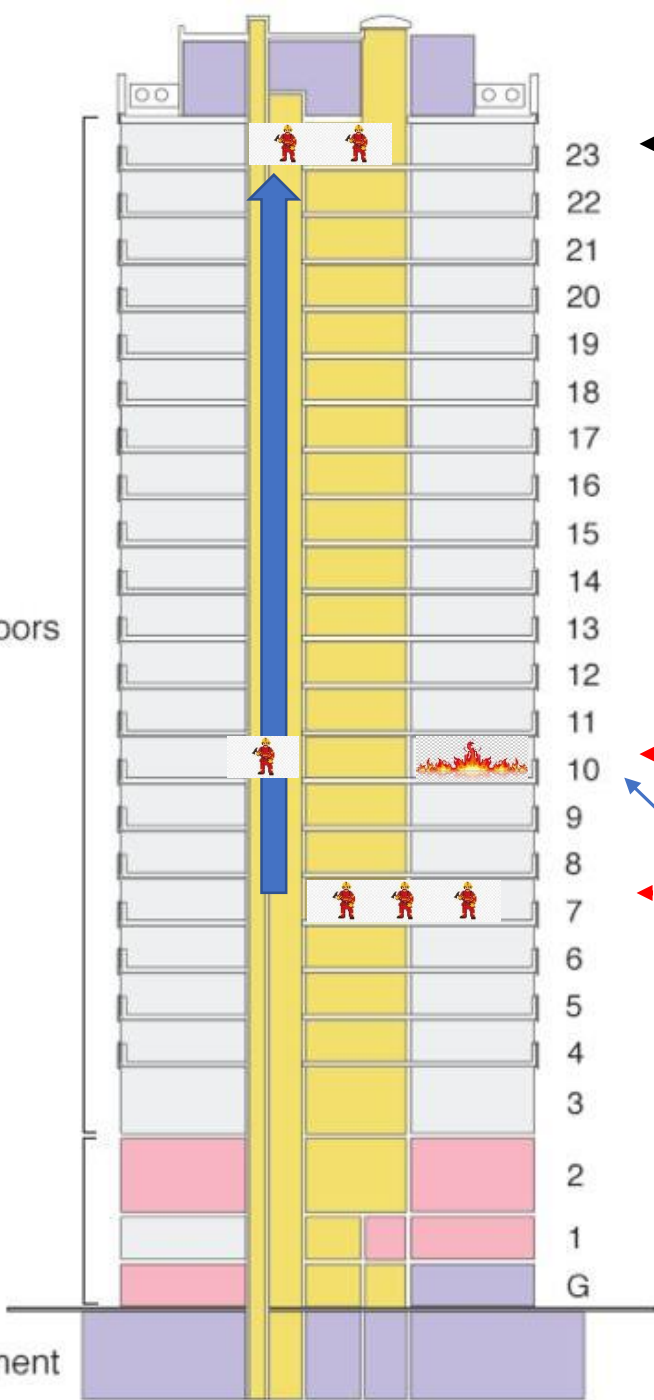
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Residential floors

Basement



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# Stairway Protection Teams

Stair Team 1



Fire Floor

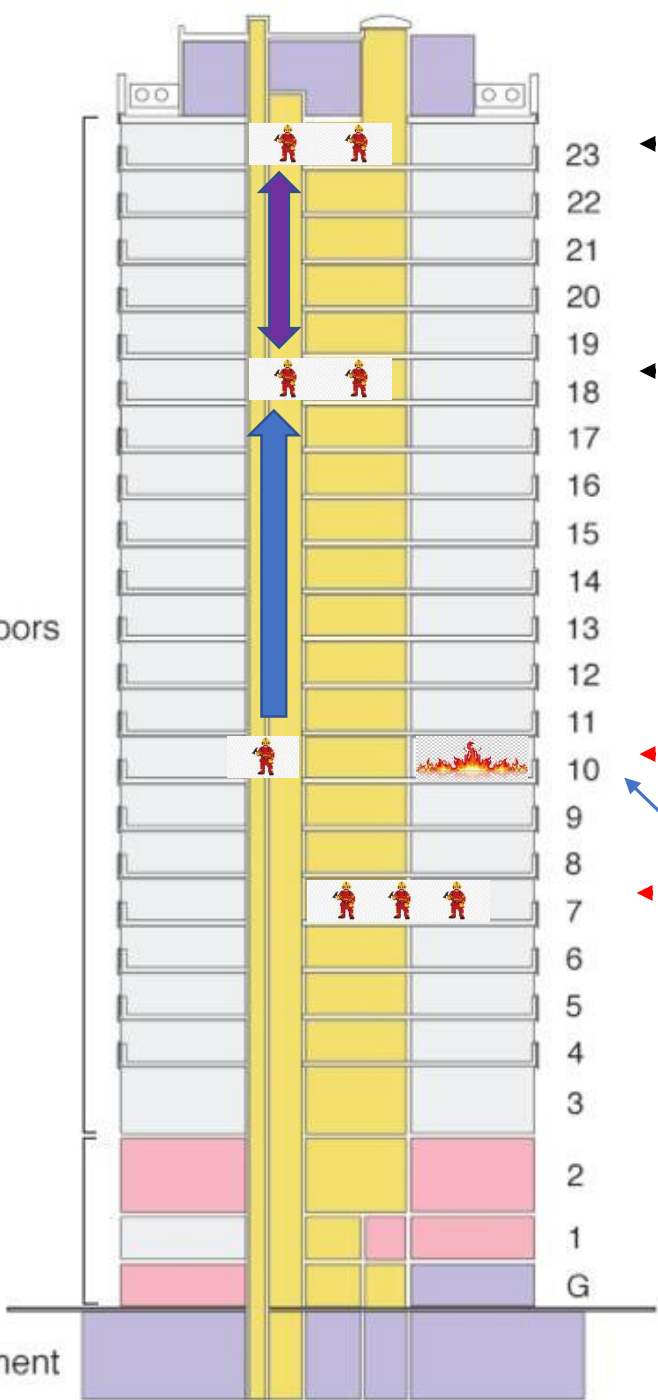
Bridgehead



# Stairway Protection Teams

Residential floors

Basement



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Stair Team 1

Stair Team 2

Fire Floor

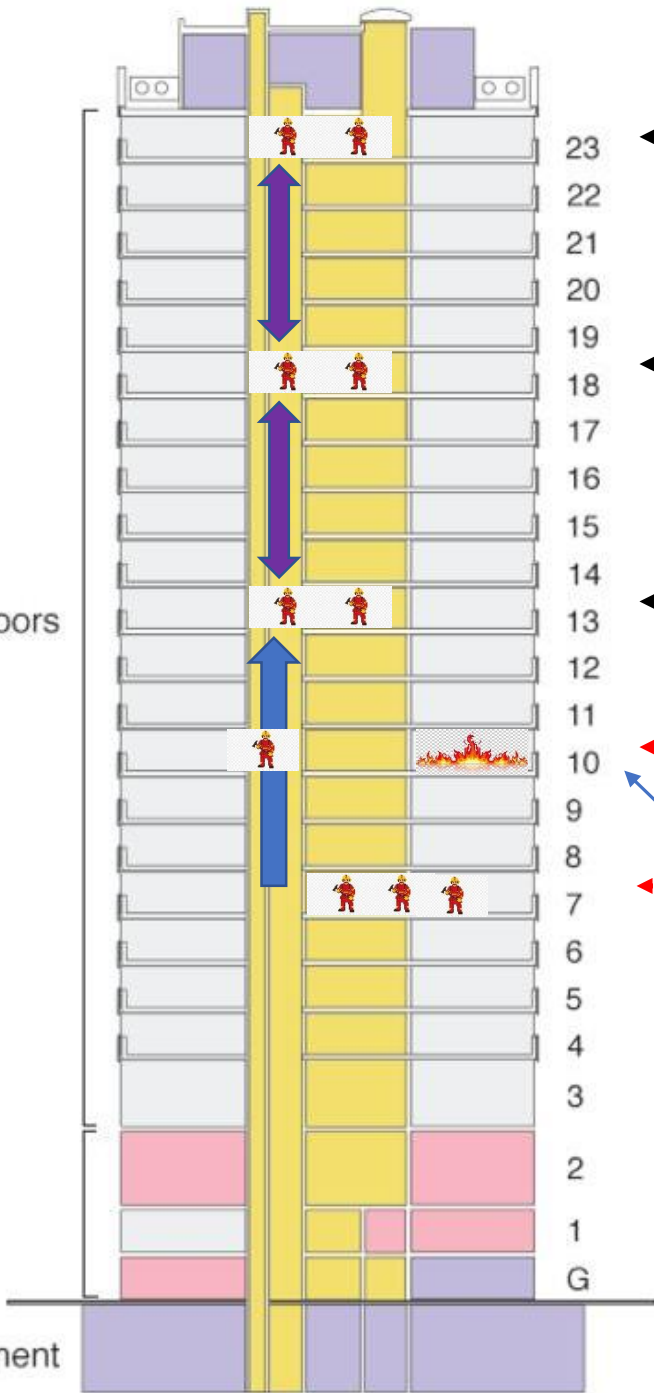
Bridgehead



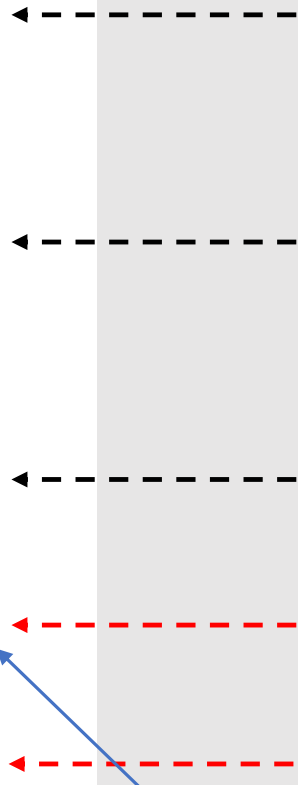
# Stairway Protection Teams

Residential floors

Basement



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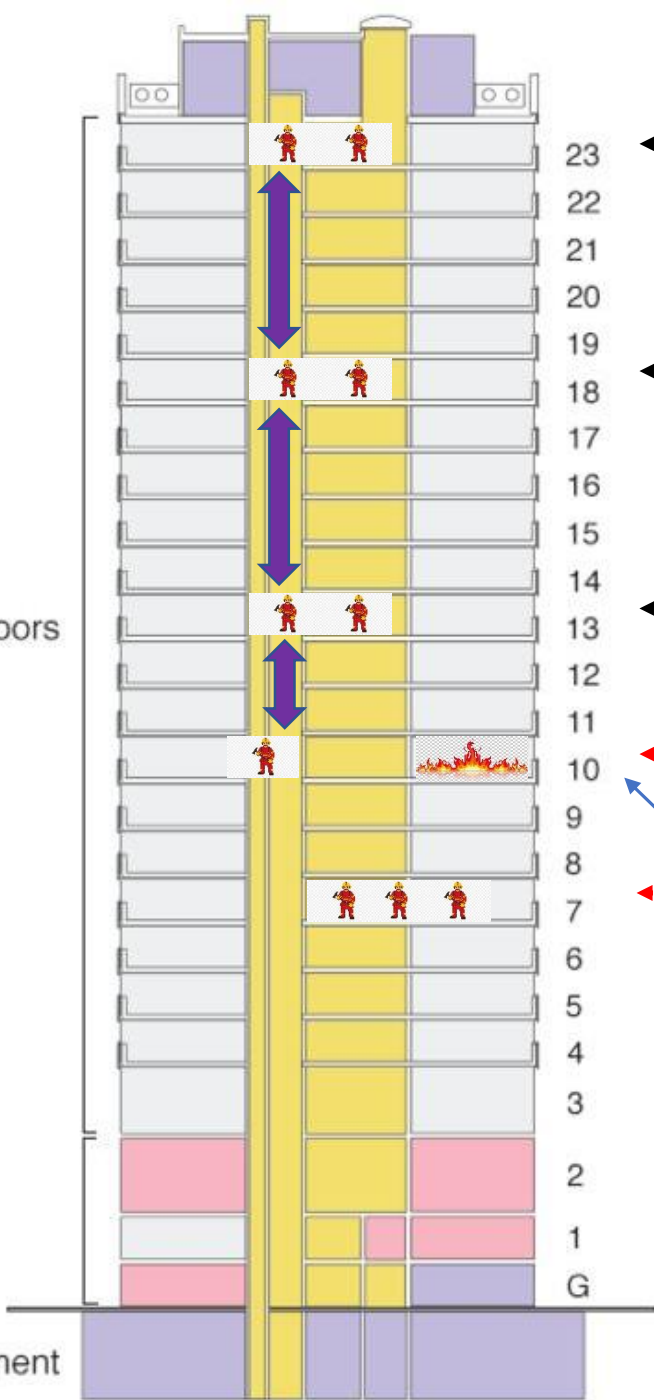
Stair Team 1  
Stair Team 2  
Stair Team 3  
Fire Floor  
Bridgehead



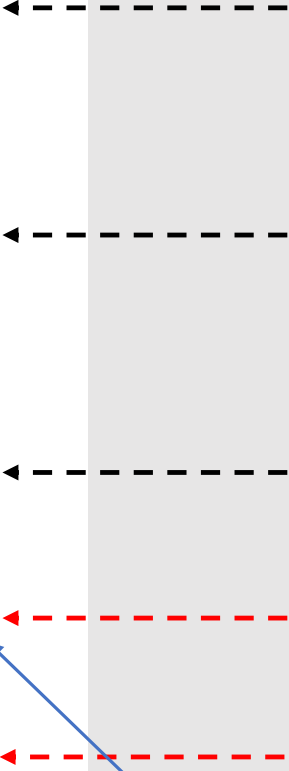
# Stairway Protection Teams

Residential floors

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Stair Team 1  
Stair Team 2  
Stair Team 3  
Fire Floor  
Bridgehead



# KFRS Model Building Recommendations

- That rising fire mains (stand-pipes) should be a minimum of **150mm** in diameter – + **2 stairs!**
- That rising fire mains should have at least **two outlets per floor level.**
- That rising fire main outlets should be located in a firefighting lobby (as in commercial buildings) or in the accommodation corridor immediately adjacent to the firefighting stair door.
- **Voice Alarms – Fire Service Control**



**Kent Fire and Rescue Service**

**Design tenability at 0.3 FED for exposure to concentrations of Carbon Monoxide**

<b>Category</b>	<b>Maximum asphyxiant concentration as CO 5 minute exposure</b>	<b>Maximum asphyxiant concentration as CO 30 minute exposure</b>
Fuel contains nitrogen (>2% by mass) such as fires in residences or retail premises	800 ppm	125 ppm
Fuel contains nitrogen (<2% by mass) such as office fires	1,200 ppm	275 ppm

*Reference: BS 7974-6*

*The 2018 changes to Carbon Monoxide and Hydrogen Cyanide are as follows:*

**Carbon Monoxide**

Current LTEL/TWA (8hrs) = 30 ppm

Current STEL (15mins) = 200 ppm

**New LTEL/TWA (8hrs) = 20 ppm**

**New STEL (15mins) = 100 ppm**

**Hydrogen Cyanide**

Current LTEL/TWA (8hrs) = N/A

Current STEL (15mins) = 10 ppm

**New LTEL/TWA (8hrs) = 0.9 ppm**

**New STEL (15mins) = 4.5 ppm**