

**Tall Buildings**  
fire safety network

www.tallbuildingfiresafety.com

7<sup>th</sup> International

# TALL BUILDING FIRE SAFETY CONFERENCE

Excel London 17-19  
May 2022

**FIREX**  
INTERNATIONAL



## *Fire Fighting*

# Smoke Control in high rise Fires

keynote



*Prof. Dr.-Ing. Michael Reick  
Göppingen, Germany*

## high rise buildings are different

- *in size, shape, use, design*
- **high / very high / ultra high**
- **safety systems:**
  - **Sprinkler**
  - **Evacuation**
  - **Lift**
  - ...
  - **Stairs**
  - **Ventilation systems**
- **maintenance**
- ...



*Reality / Expectation / Code*

*... around the world ...*

*Reality / Expectation / Code:*

**Office buildings:**

- *often acc. to code*

**Residential Buildings:**

- **“often somehow broken”**
- => **We have to prepare for that**  
**(expect that)**
- **Fire is often “contained”**
- **Smoke is often out of the**  
**compartment of origin**



- => *we should expect this to happen - but should not accept it*
- => *never use this expectation as an excuse ...!*
- => *Fire Fighting should not contribute to smoke spread*

*... around the world ...*

# https://en.wikipedia.org/wiki/List\_of\_fires\_in\_high-rise\_buildings

https://en.wikipedia.org/wiki/List\_of\_fires\_in\_high-rise\_buildings



			<a href="#">Emirates</a>			
<a href="#">Sulafa Tower</a>	288m	<a href="#">Dubai</a>	<a href="#">United Arab Emirates</a>	July 20, 2016	0	
<a href="#">Plasco Building</a>	42m	<a href="#">Tehran</a>	<a href="#">Iran</a>	January 19, 2017	21	The 17-story building collapsed after a fire started on the ninth floor. Seventy injured. <sup>[38]</sup>
<a href="#">Grenfell Tower</a>	79.2m	<a href="#">London</a>	<a href="#">United Kingdom</a>	June 14, 2017	72	The 24-storey tower block fire spread from the second floor to the top of the building. <sup>[39]</sup> See <a href="#">Grenfell Tower fire</a>
<a href="#">Pamchal Chitgar Building</a>	66m	<a href="#">Tehran</a>	<a href="#">Iran</a>	June 14, 2017	0	The residential 20-storey tower - four injured
<a href="#">Marco Polo Apartments</a>	118.8m	<a href="#">Honolulu</a>	<a href="#">United States</a>	July 14, 2017	3	Blaze started on the 26th floor of the 36-story apartments. Fire quickly spread to three more floors, making it a 5-alarm fire. This is the deadliest high-rise fire in Hawaii's history.
<a href="#">Rotana Hotel Building</a>	66m	<a href="#">Mashhad</a>	<a href="#">Iran</a>	July 22, 2017	0	Under construction 20-storey hotel
<a href="#">The Marina Torch</a>	336.8m	<a href="#">Dubai</a>	<a href="#">United Arab Emirates</a>	August 4, 2017	0	
<a href="#">Trump Tower</a>	202m	<a href="#">New York City</a>	<a href="#">United States</a>	April 7, 2018	1	6 firefighters injured
<a href="#">Almas Tower</a>	360m	<a href="#">Dubai</a>	<a href="#">United Arab Emirates</a>	April 22, 2018	0	
<a href="#">Trump International Hotel and Tower (Baku)</a>	108.9m	<a href="#">Baku</a>	<a href="#">Azerbaijan</a>	April 28, 2018	0	Involved two separate fires the same day
<a href="#">Wilton Paes de Almeida Building</a>	79.2m	<a href="#">São Paulo</a>	<a href="#">Brazil</a>	April 30, 2018	7–9	Building collapsed shortly after blaze
<a href="#">Paramis Building</a>	69.3m	<a href="#">Tehran</a>	<a href="#">Iran</a>	July 22, 2018	0	21-storey residential building
<a href="#">Bank of Lisbon building</a>	108m	<a href="#">Johannesburg</a>	<a href="#">South Africa</a>	September 6, 2018	3	Building demolished/Imploded in 24 Nov 2019
<a href="#">FR Tower</a>		<a href="#">Dhaka</a>	<a href="#">Bangladesh</a>	March 28, 2019	25	<a href="#">FR Tower fire</a>
<a href="#">AXA Equitable Center</a>	229.3m	<a href="#">New York City</a>	<a href="#">United States</a>	June 10, 2019	1	<a href="#">2019 New York City helicopter crash</a>
<a href="#">Unnamed Highrise</a>	47.9m	<a href="#">Prešov</a>	<a href="#">Slovakia</a>	December 6, 2019	8	40 injuries <sup>[40]</sup>
<a href="#">Abbco Tower</a>		<a href="#">United Arab Emirates</a>	<a href="#">United Arab Emirates</a>	May 5, 2020	1	25 injuries, likely started by a discarded cigarette or shisha coals <sup>[41]</sup>
<a href="#">Unnamed Highrise</a>	42.9m	<a href="#">Czech Republic</a>	<a href="#">Czech Republic</a>	August 9, 2020	11	<a href="#">Bohumín arson attack</a>
<a href="#">Ulsan Samhwan Art Nouveau apartment building</a>	108.9m	<a href="#">South Korea</a>	<a href="#">South Korea</a>	October 8, 2020	0	92 residents and 1 firefighter injured. <a href="#">Ulsan Samhwan Art Nouveau Fire</a> <sup>[ko]</sup> <sup>[42]</sup>
<a href="#">Torre dei Moro</a>	60m	<a href="#">Milan</a>	<a href="#">Italy</a>	August 29, 2021	0	Fire event similar to the Grenfell Tower disaster <sup>[43]</sup>
<a href="#">Cheng Chung Cheng Building</a>		<a href="#">Kaohsiung</a>	<a href="#">Taiwan</a>	October 14, 2021	46	<a href="#">2021 Kaohsiung tower fire</a>
<a href="#">World Trade Centre Hong Kong</a>		<a href="#">Hong Kong</a>	<a href="#">Hong Kong</a>	December 15, 2021	0	13 injured, over 300 trapped on roof <sup>[44]</sup>
<a href="#">Twin Parks North West, Site 4</a>		<a href="#">New York City</a>	<a href="#">United States</a>	January 9, 2022	17	<a href="#">2022 Bronx apartment fire</a>

01/05/2022

09.01.2022; NY, Bronx, USA

## Fire in floor 2 and 3; Smoke in floor 12?



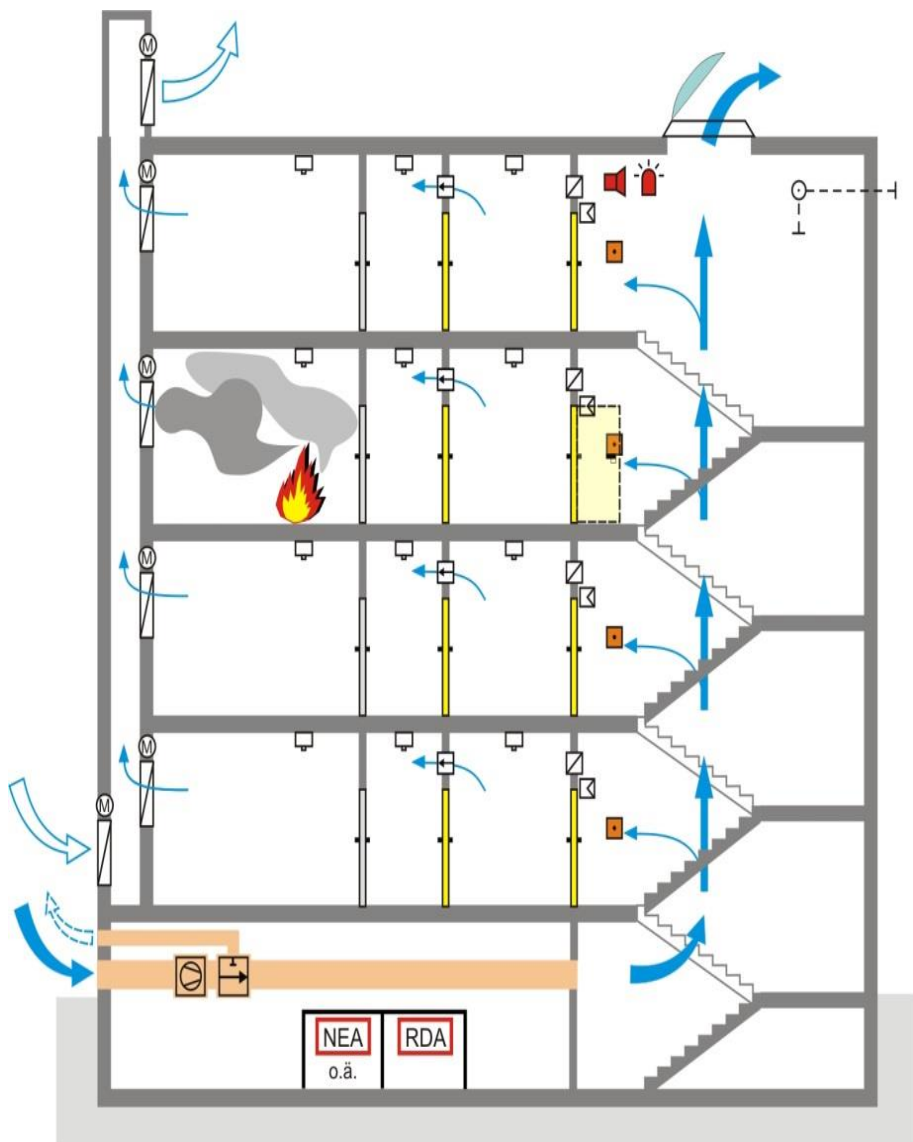
**17** KILLED BY SMOKE  
INHALATION

**72** HURT

**35** LIFE-THREATENING  
INJURIES



Fire Fighters have to understand the principles of complex ventilation systems – and should not work in conflict with them



... personal experience ...

what our participants might  
have in mind ...



Manhattan  
John Street  
11/2016



12/2021 - Germany



08/2022 Italy

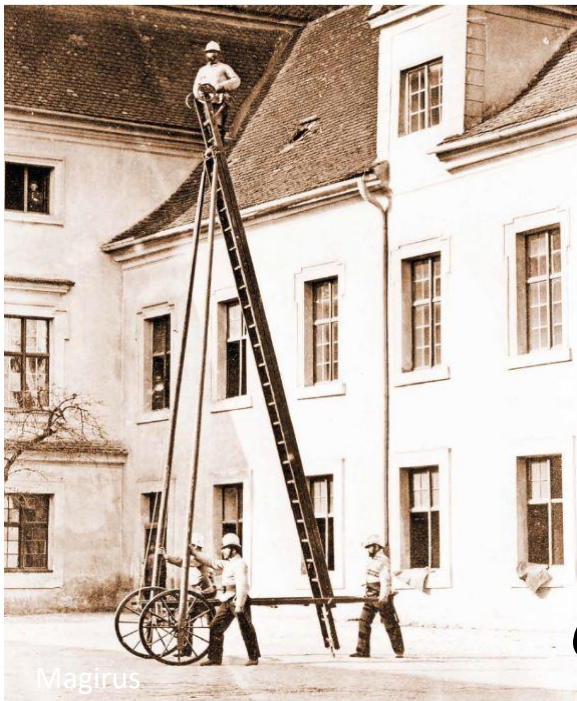


Grenfell Inquiry, UK



01/2022 US





Magirus

BSPP Paris



*Our Fire Fighting Experience is influenced by our equipment, tactic, training, members, built environment and tradition*



Magirus

# Successful Fire Fighting

## Tactical Decision



Rescue People

Extinguish the Fire

Air/Smoke Flows

or  
Defend in Place  
*Safe Place Concept*

Fire Ventilation  
*Fire Dynamics*

Hazardous Areas / Safe Attack & Egress Routes

(Smoke = Toxic Gases + High Temperature + Low Visibility )  
=> Stairway Protection / Smoke Flow Control is a key factor

**New York  
Manhattan  
John Street  
Nov. 2016**



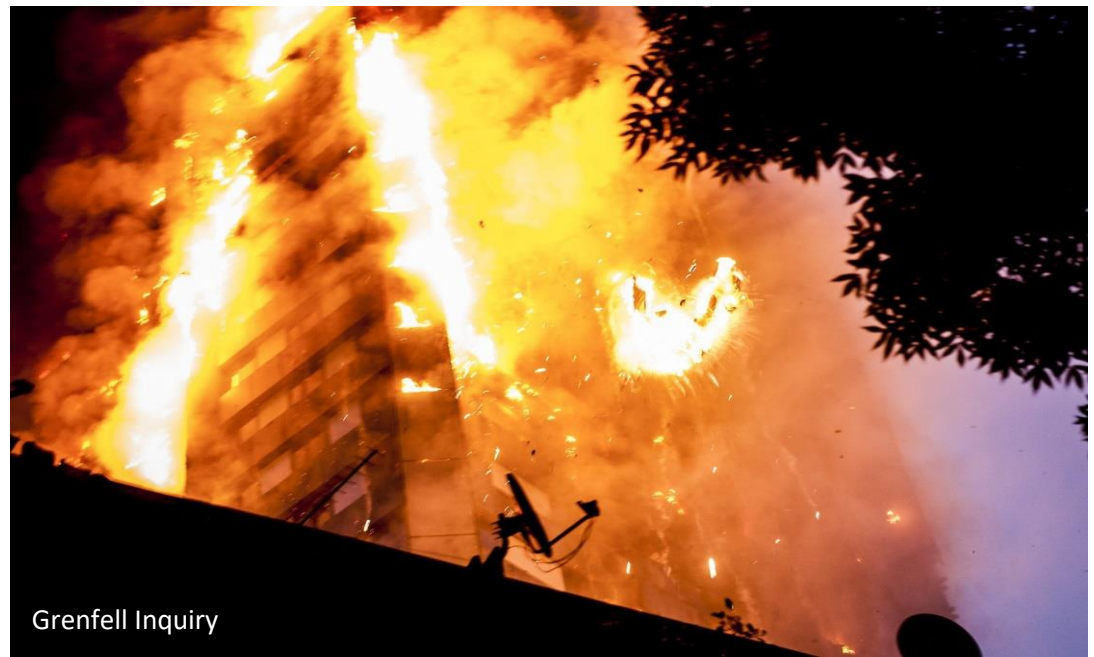
**Manhattan  
John Street  
11/2016**

**View from a Civilian:**

**<https://www.youtube.com/watch?v=GqozRpx9BlI>**

# Fire Spread to Top of East Face

01:29



*Two of many lessons learned !?*



Rescue through smoke!  
=> smoke hoods

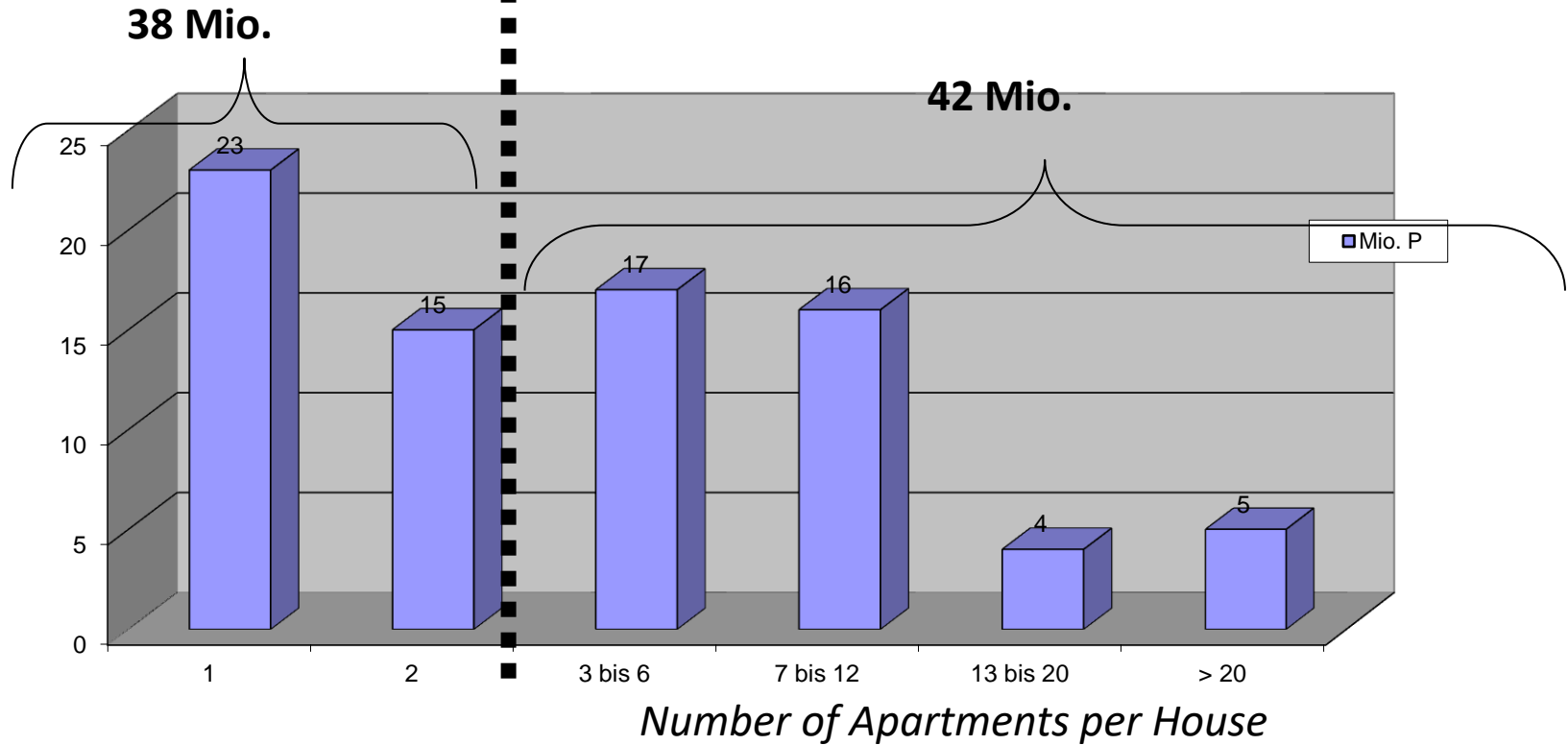


Stairway protection!  
=> smoke curtains

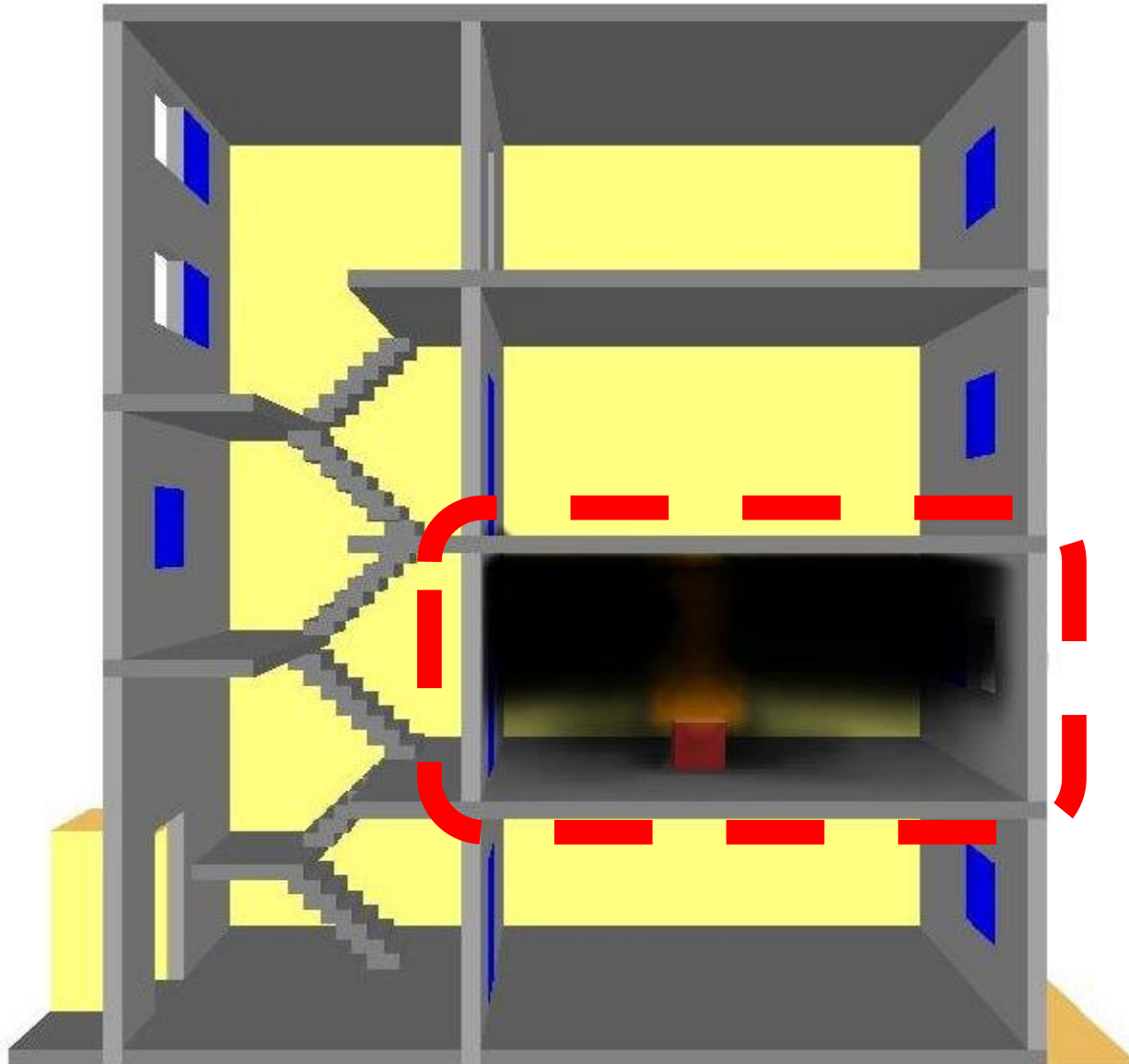
# Housing Situation in Germany



Mio. of people living in these houses



# Flow Path Control



*Fire in a closed  
compartment  
vs.  
Fire with flows ?*

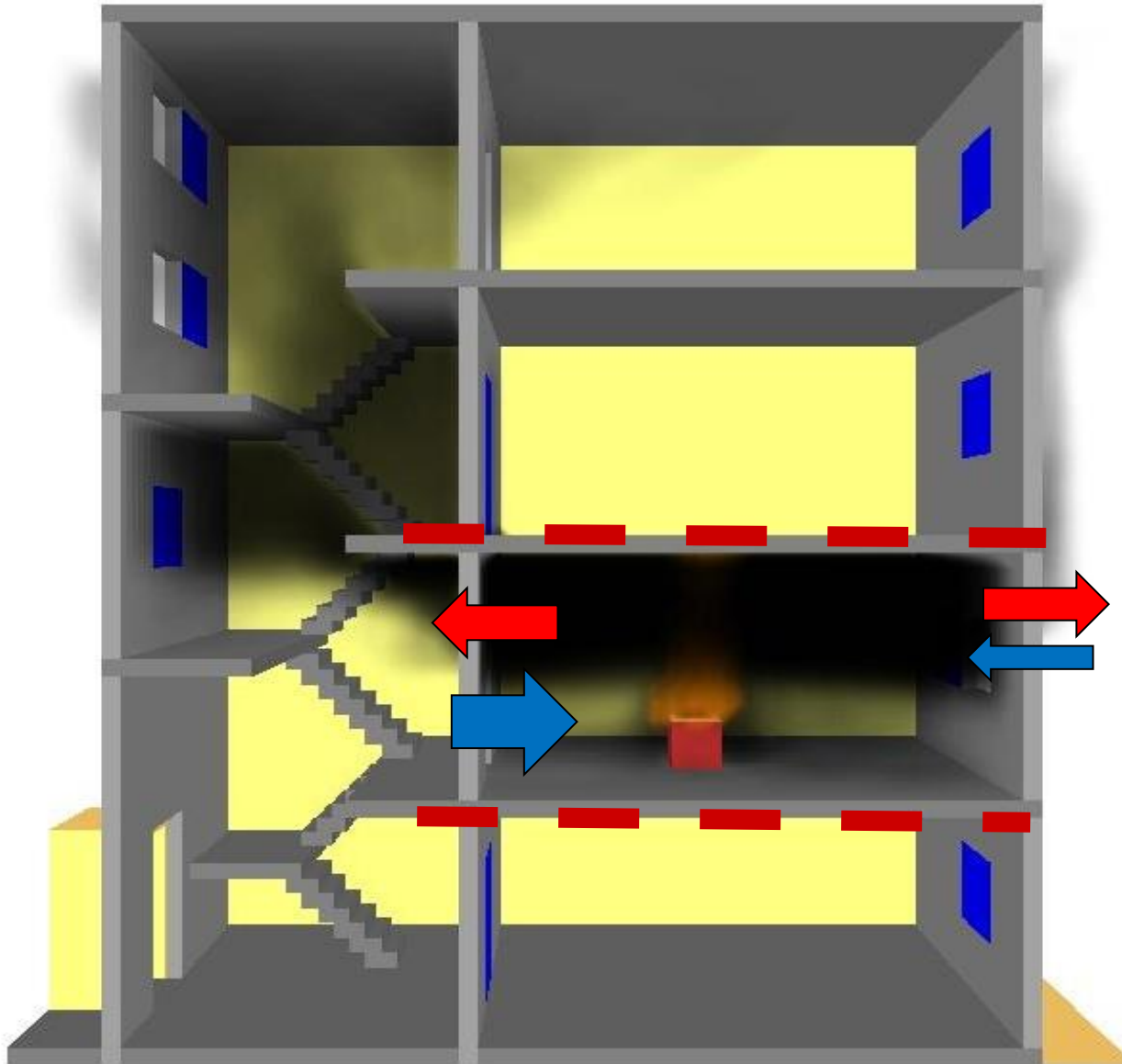
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*Extinguishment  
vs.  
Containment ?*

---

*SOPs?*

# Multiple Flows / Bi – or Uni-Directional Flows



*Fire can exchange  
gases within the  
building and/or  
to the outside:*

*Flow of Smoke  
Flow of Air*

Fire in a multi-story building:

***The stairway is the most important room !***







Interior attack:  
**open doors allow**  
***a) smoke spread***  
***b) air flow to the fire***

Interior attack:

**First hoseline  
interferes with the  
safety design of  
the building!**

Door squeezes  
the first line!

***Train in these  
buildings!***



# 7 possibilities to do “Door Control”

- 1) Keep the door closed
- 2) Close the door behind you
- 3) Control the door with staffing
- 4) Control the door with a chock, ..
- 5) Cut the door partially
- 6) *Prepare all doors for that purpose*
- 7) ***Control openings as needed with a tool***



6



1



2



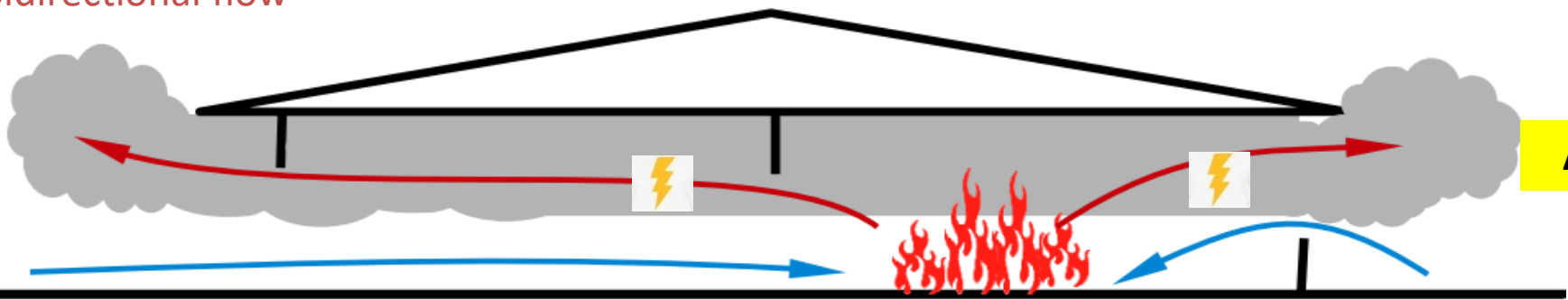
4



5



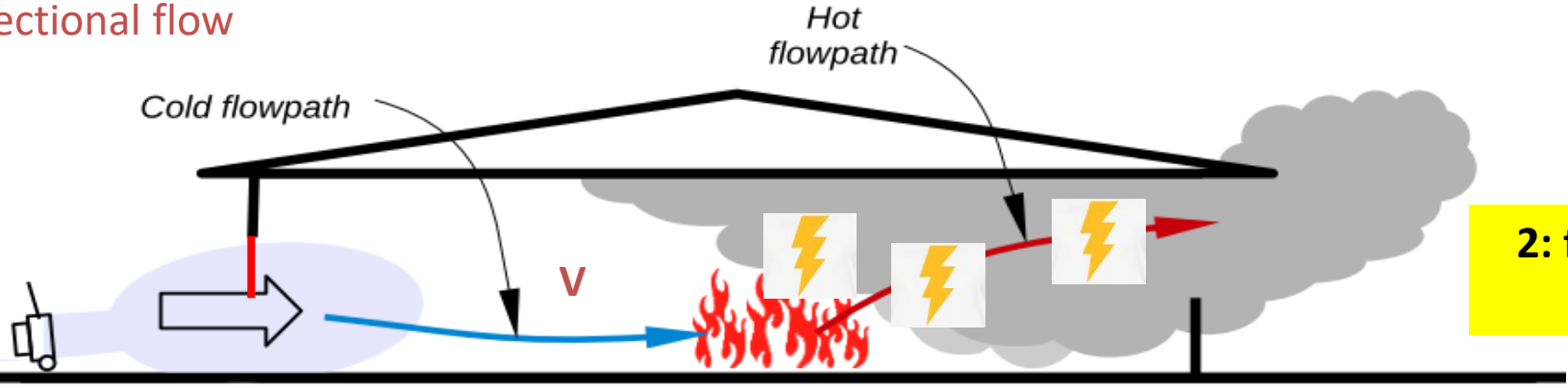
Bidirectional flow



A

Always avoid:

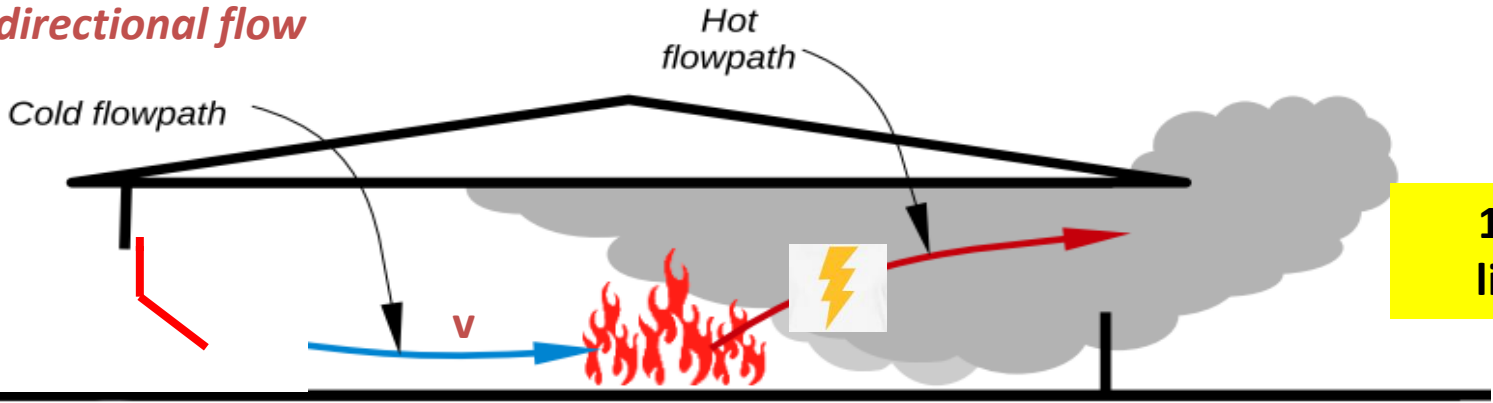
Unidirectional flow



B

2: fire controlled:  
ventilate!!

Improved unidirectional flow



C

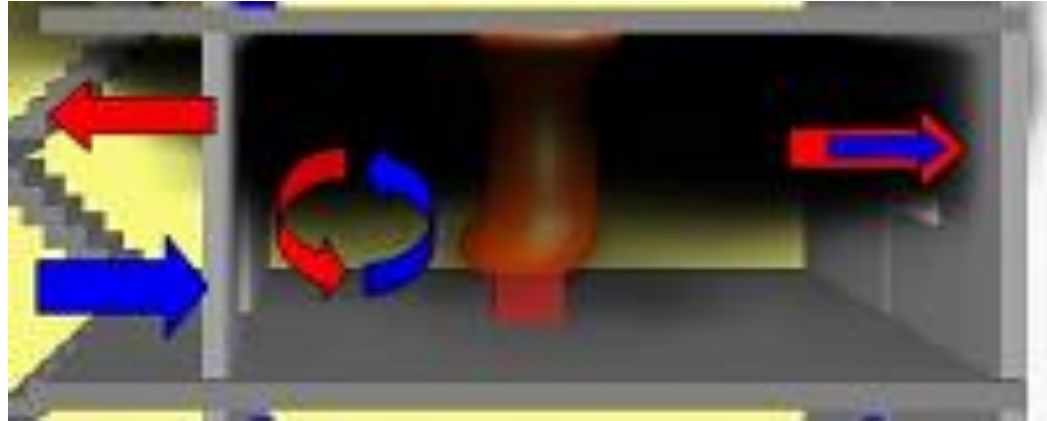
1: Start safe:  
limit air flow

# Improved unidirectional flow

## Bidirectional flow

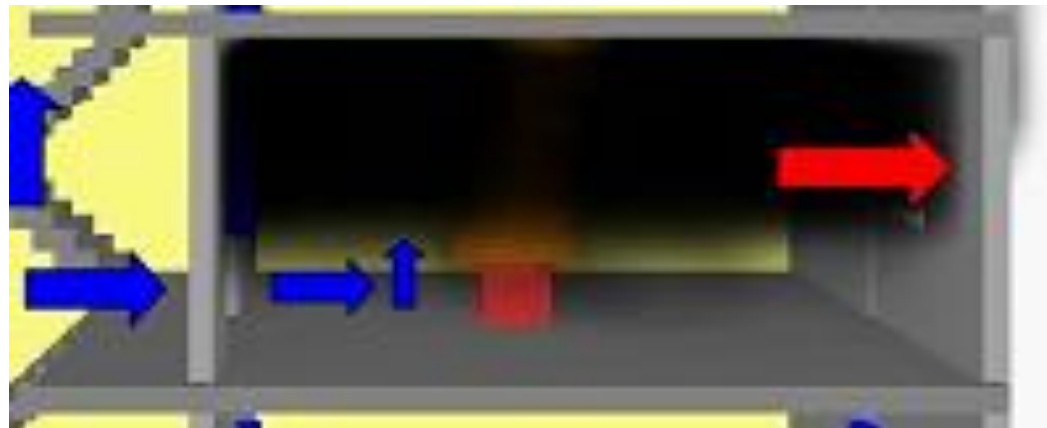
creates a lot of turbulence

increases volume of ignitable gases

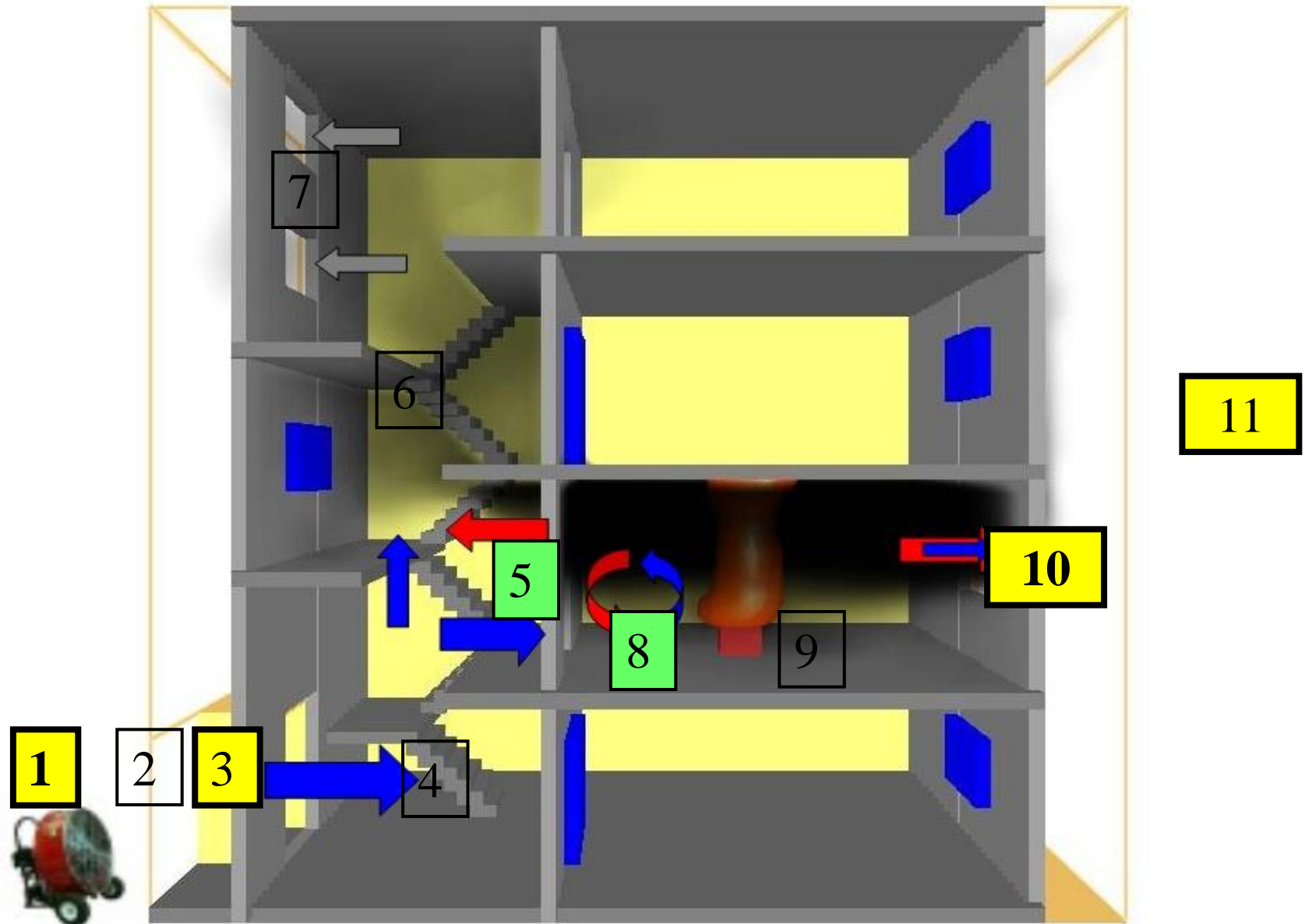


## *Improved* unidirectional flow !

Just with blocking the upper part of the entrance door!



# Major influences on fire ventilation





Apartment fire in Heilbronn - 2006



Apartment fire in Munich – 2008



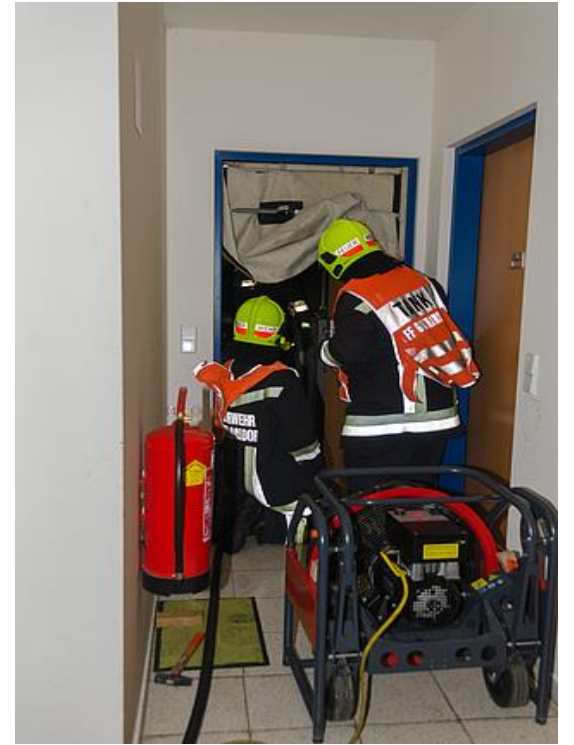


26.10.2009 – Würzburg  
Fire in Hospital



Foto: S. Rasch

Berlin 2013



Apartment fire in Vienna – 2014

# Hongkong 2015 highrise





 **Pompiers de Paris**  
5. Juli um 16:15 · 🌐

Retour en images sur le violent feu d'appartement au Blanc-Mesnil (93).

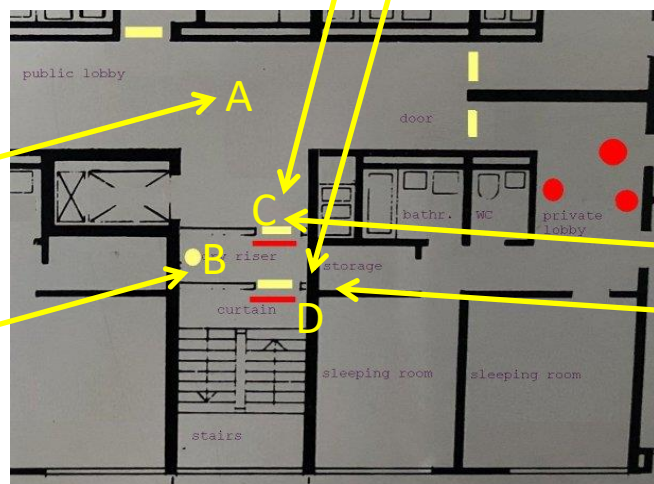
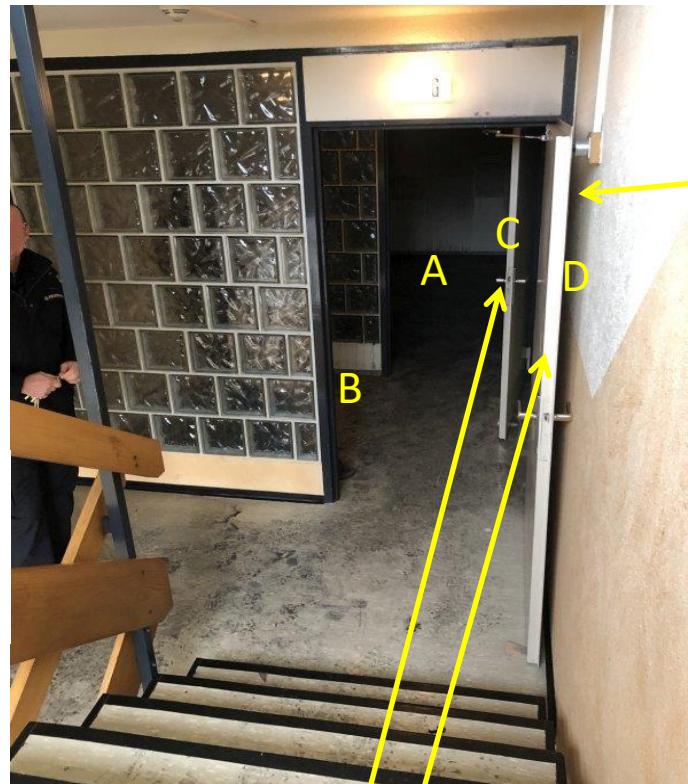
#Intervention 🚒 Retour en images sur le violent feu d'appartement au Blanc-Mesnil (93)...



Paris  
July 4, 2020



Highrise Fire in Göppingen,  
Germany,  
Nov. 21, 2019



Fully developed apartment fire with 1 person inside; A: lobby / B: dry riser / C+D: double door system double door system to stairs with dry riser water supply between the doors; smokestopper used!

## *some universal statements*

**The experience of the fire service  
all around the world is limited to ...**

- “... how we have always done it”
- ... the equipment we used so far
- ... how we trained and fought so far

# *some universal statements*

## **Be aware of yourself and your environment**

- *Buildings*
- *Society*
- *Fire service*  
*(tradition, strength, experience)*
- *What others do differently and why*





## *some universal statements*

**Know your strategy:**



**“Rescue”**

**vs.**

**“Extinguishment”**

**a) “Full Evacuation”**

**a) aggressive**

**b) “Defend in place”**

**b) defensive**

*(confinement)*

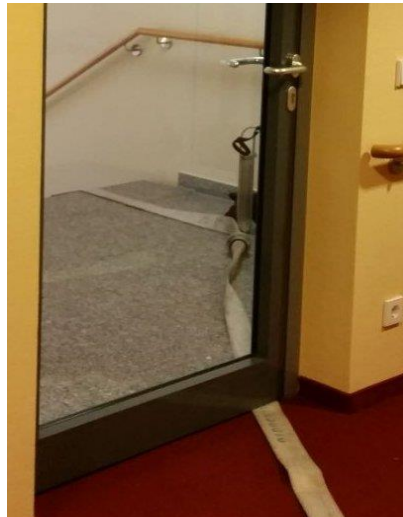
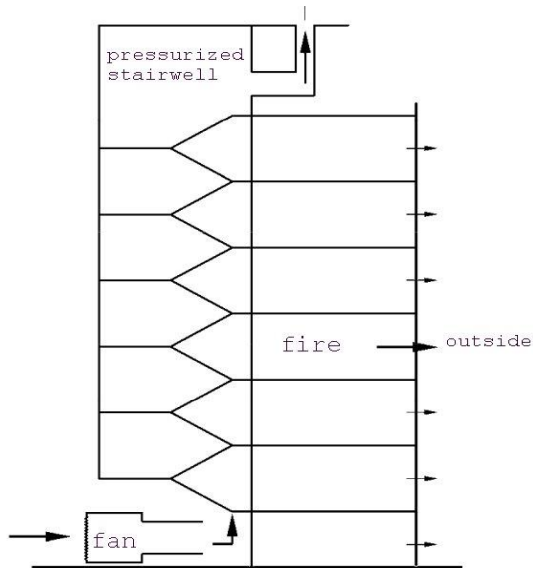
**Know the basics:**

- **Tactics**
- **Fire dynamics**
- **Skills for Extinguishment**
- **Smoke spread control**

# *some universal statements*

## Smoke spread control is essential

- Know your environment regarding building ventilation and that you interfere with it!
- Nearly every action on the fire ground can influence smoke spread!
- Smoke is killing people!



# *some universal statements*

**Be able to do basic things that are common around the world!**

- **Protect the stairway!**

*Given building systems / smoke curtains*

- **Get water on the fire – fast!**

*But do not encourage fire and smoke spread*

- **Rescue through smoke filled areas!**

*Smoke hoods (filter and air supply)*

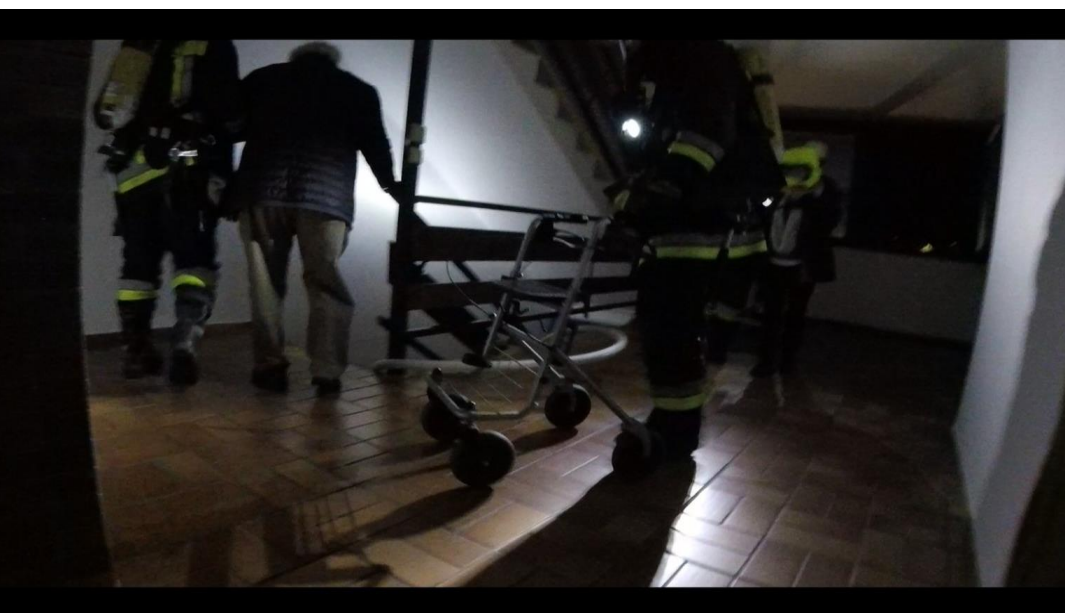


Attack-Team:  
Equipped to rescue one  
person with smoke hood  
(filter vs. air supply)

RIT-Team:  
Equipped to rescue one  
unconscious person up to  
four cooperating civilians



***Be able to rescue through smoke filled stairs!***



# *some universal statements*

**Stabilize the situation first  
(do not make it worse!)**

*Do not allow smoke spread*

**Protect egress routes (stairways!)**

*Especially if you use a “stay in place” tactic*



# Smoke Control and Stairway protection is essential (especially in highrise fires!)

