

Resistance to smoke spread with sprinkler

Combined with HVAC (Dutch standard NEN6075)



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Royal HaskoningDHV

- International team
- Independent
- Innovative

140

jaar ervaring

6000+

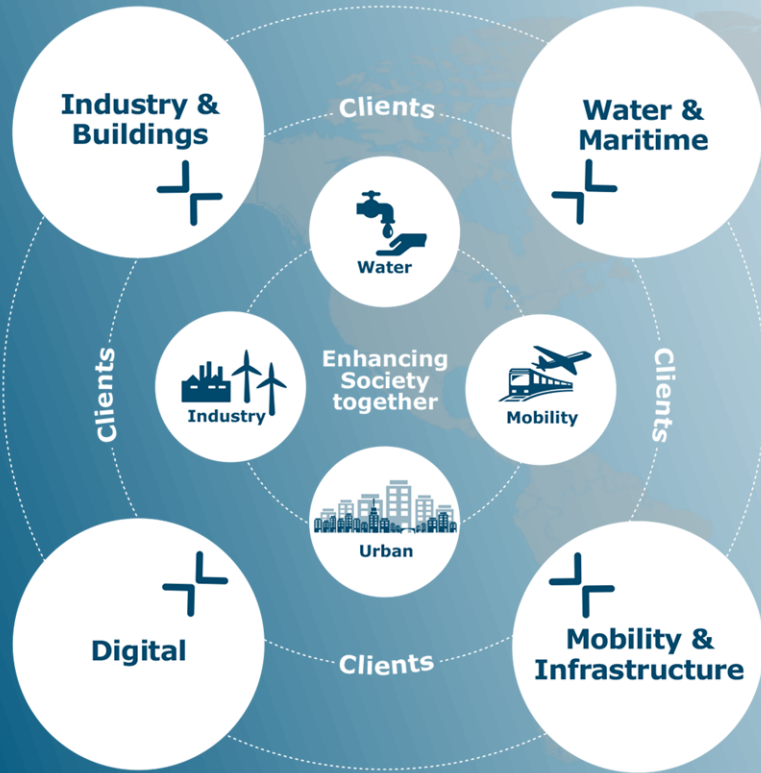
medewerkers

140+

landen



Royal HaskoningDHV



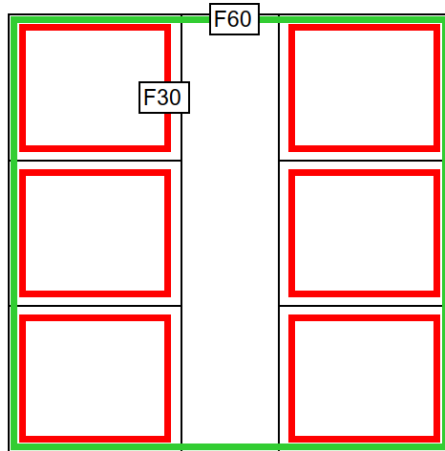


Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp.,

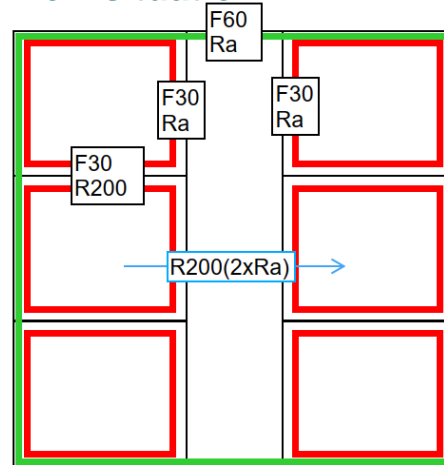
Reason research

- New standard NEN6075
- Motorized fire dampers

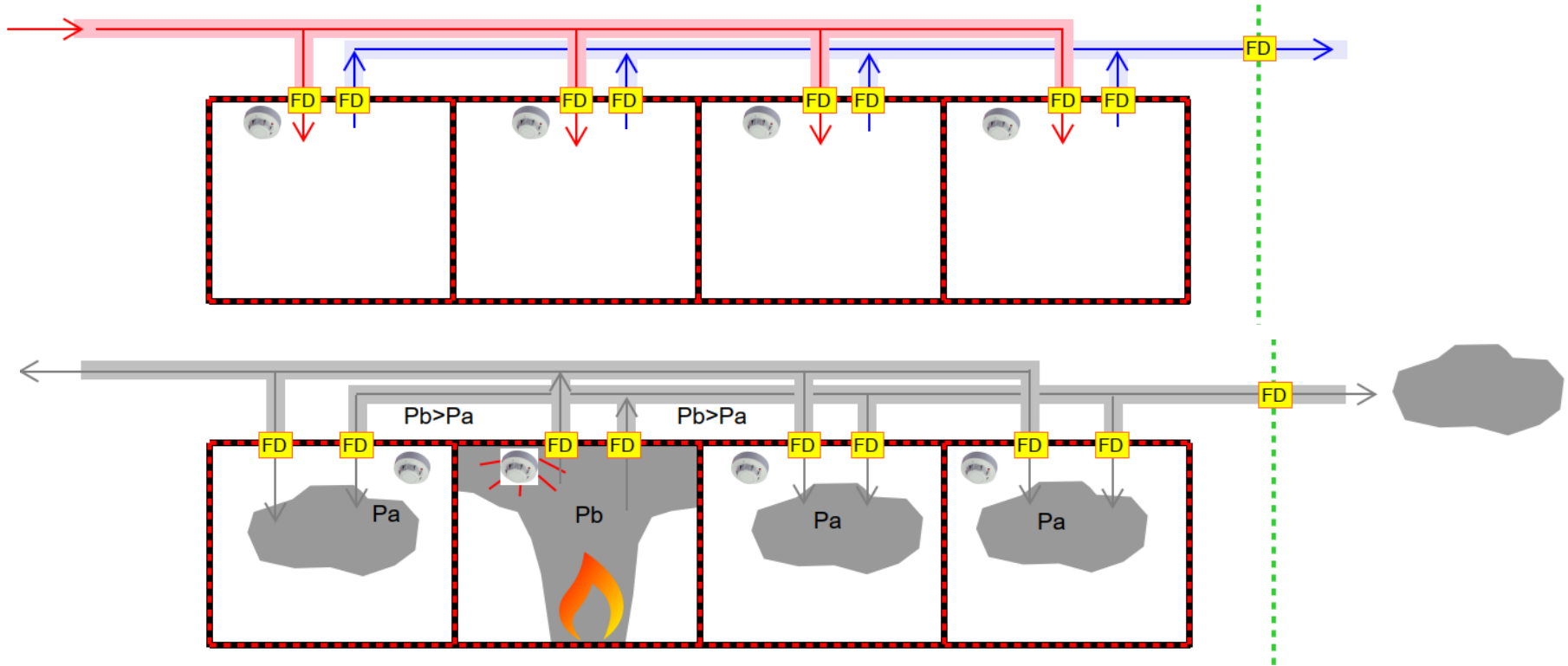
Old situation



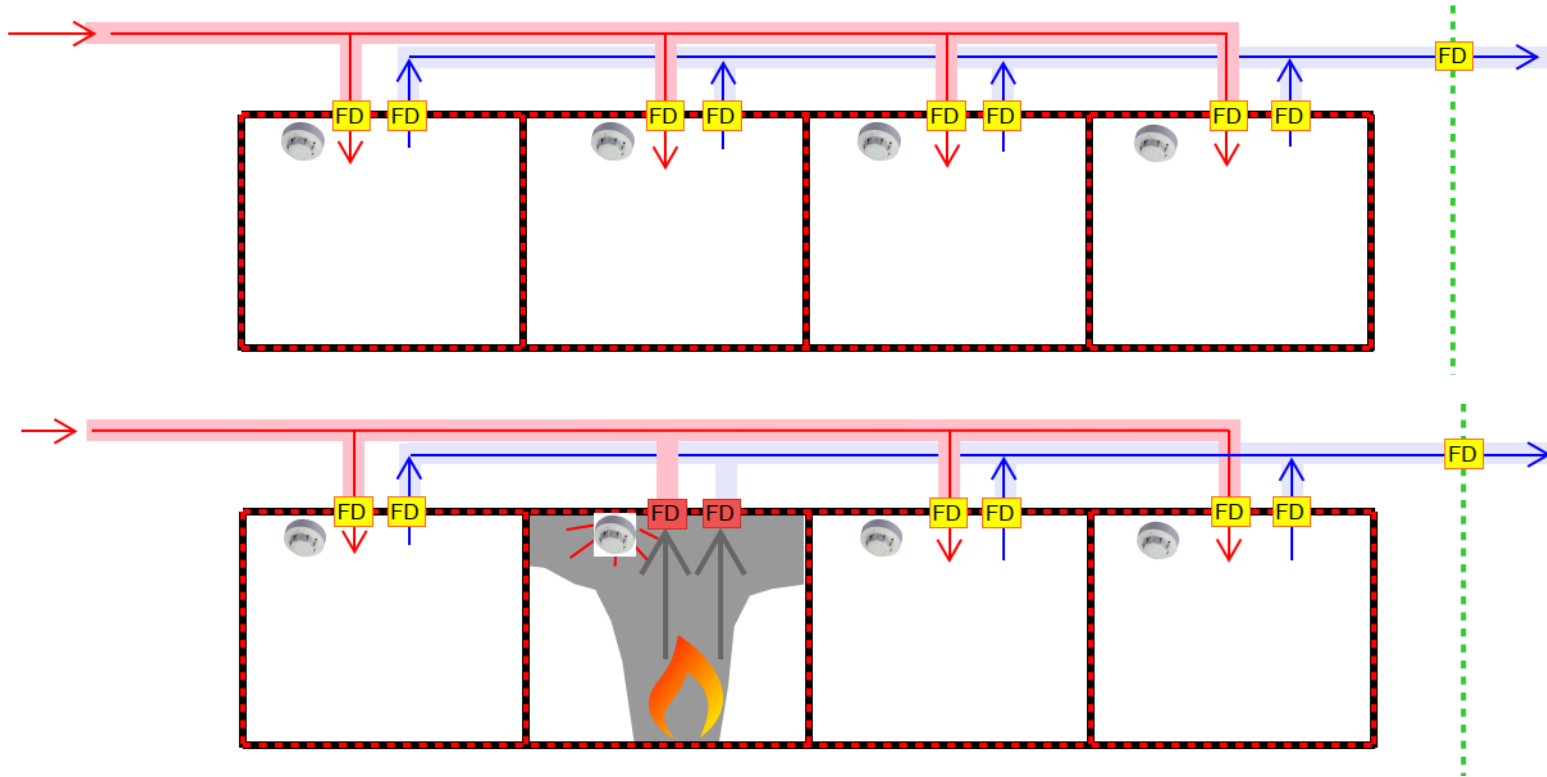
New situation



Old: fire damper with fusible link

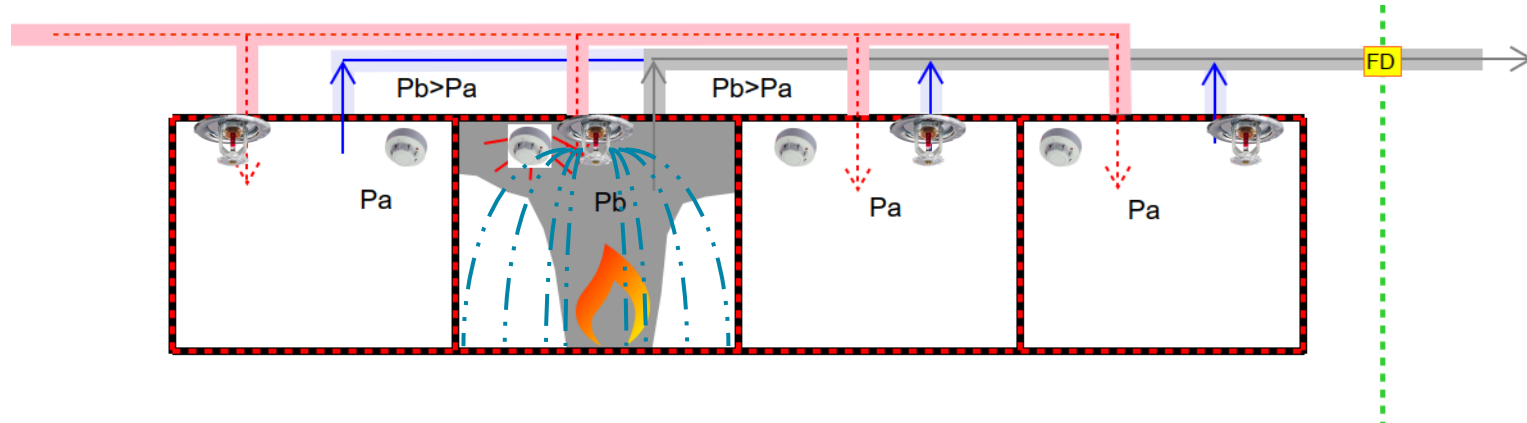


New: fire damper with motor – activated by detector



Research: sprinkler and control HVAC

- Shut off air supply
- Maintain exhaust



Research

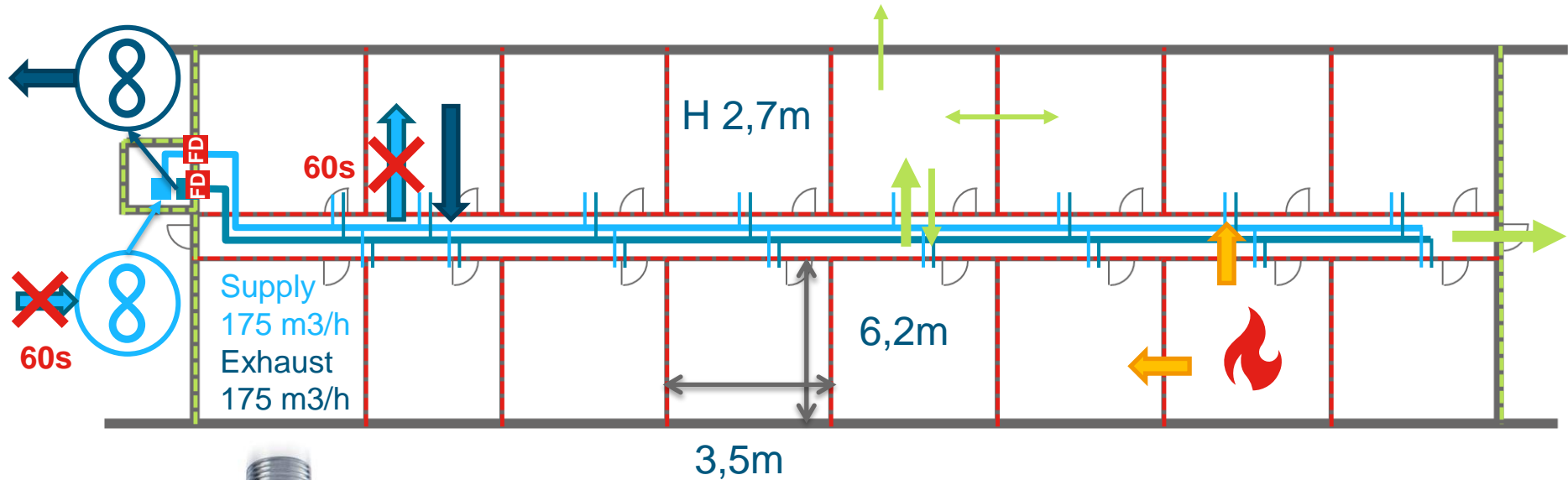


nhow Amsterdam RAI



Noordwest ziekenhuisgroep

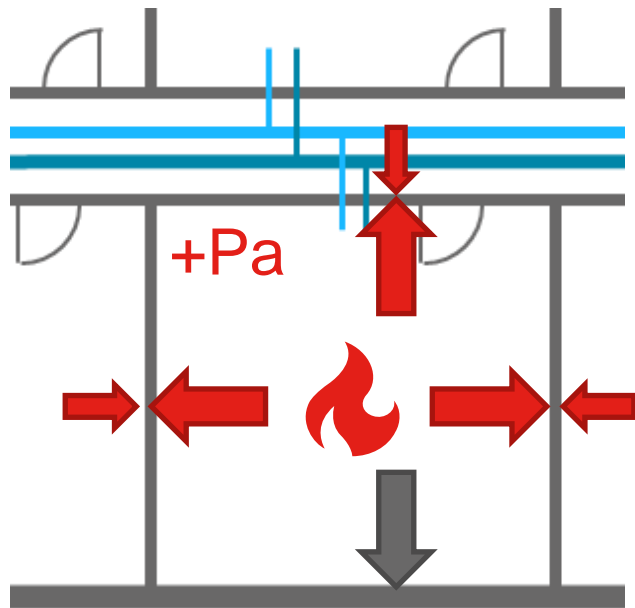
Research – starting points and goal



57 °C, QR

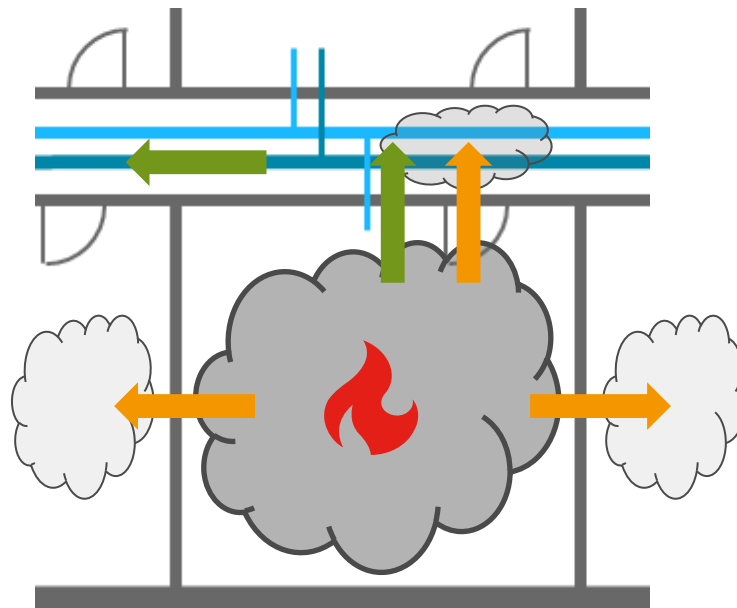
Goals

Standard NEN 6075



$\Delta P < 10 \text{ Pa}$

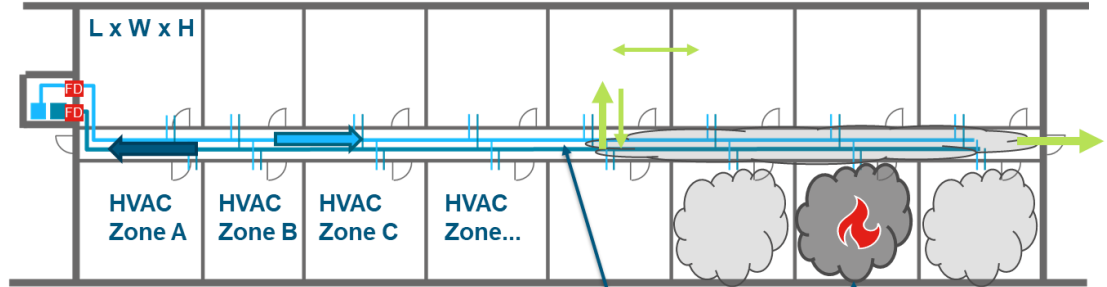
Additional



Smoke spread < 0,02 g/m³

Temperature < 200 °C

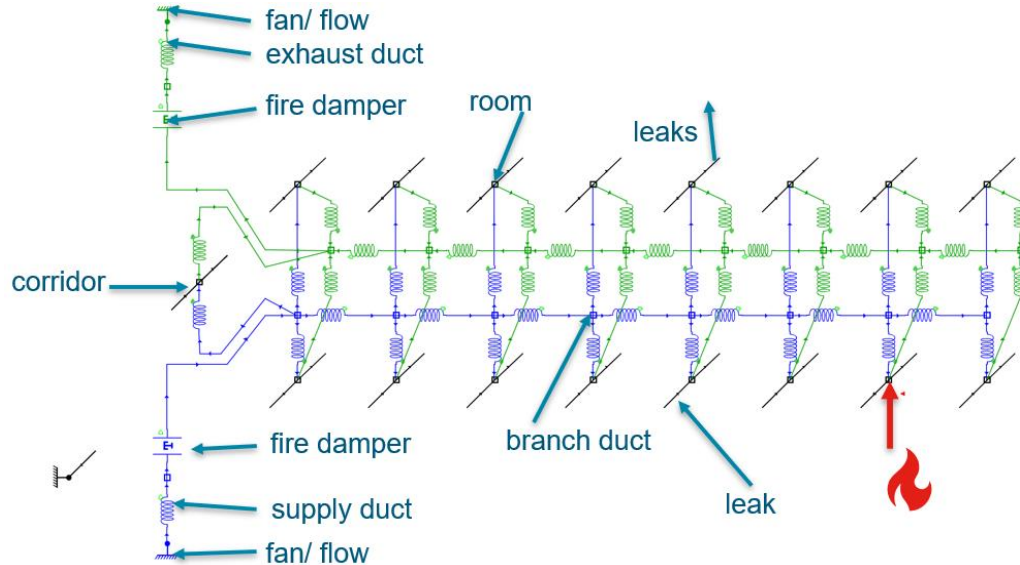
Research model



Software: Sylvia

HVAC
Zone corridor

HVAC
Zone G
Fire 2-zone
1. Cold zone
2. Hot zone (smoke)

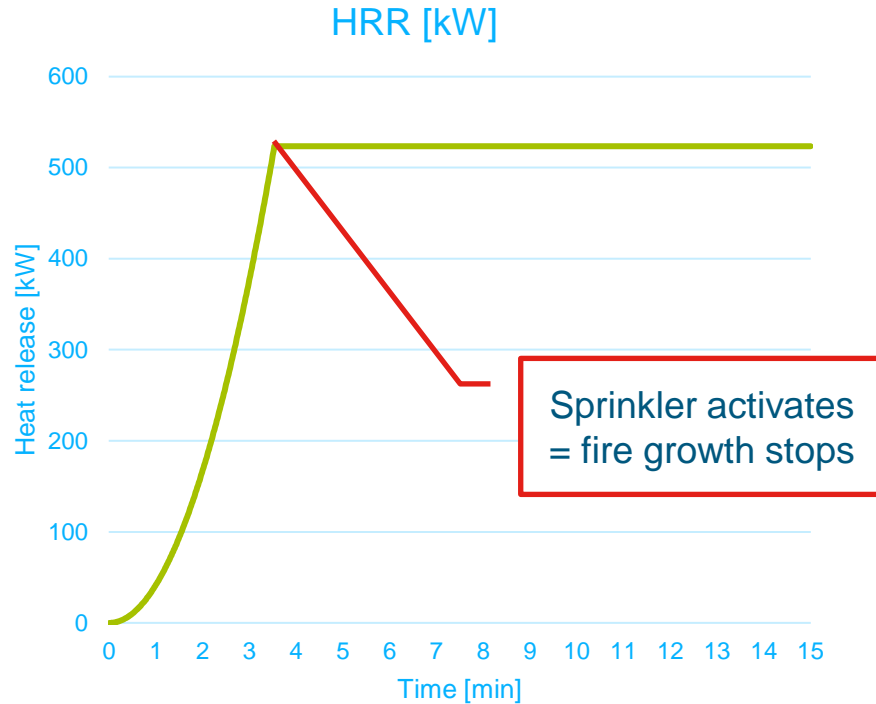


Model:
Sylvia v12.0

Fire room:
2-zone model

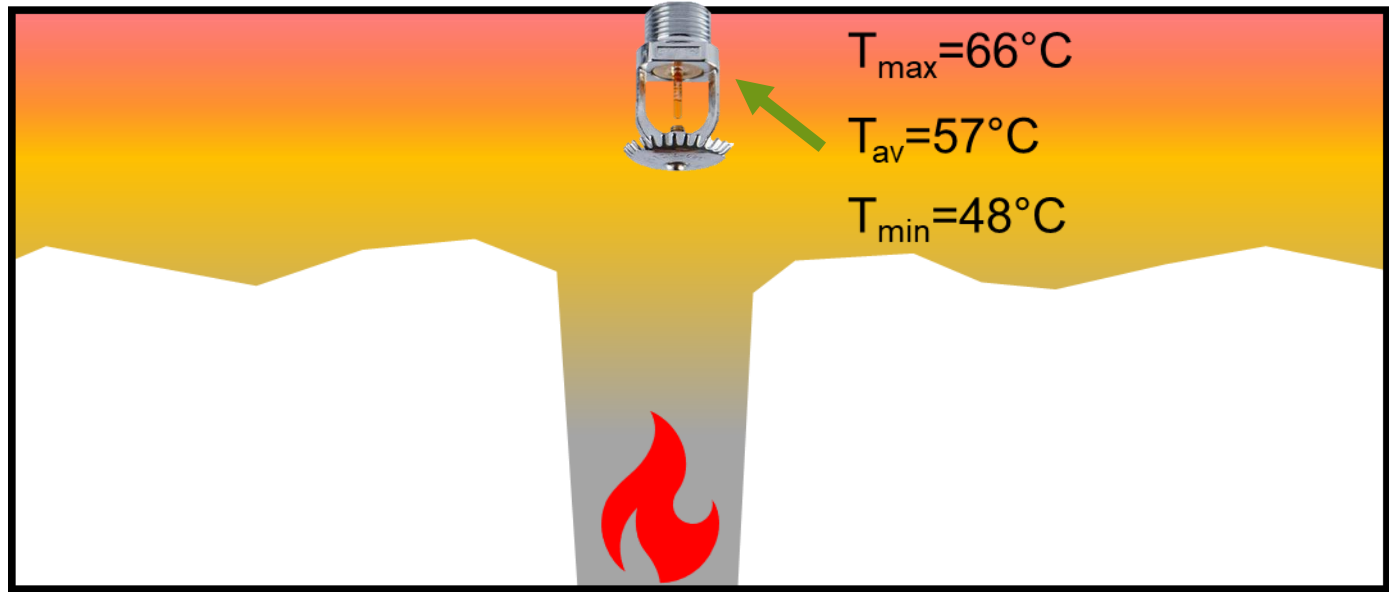
Other rooms:
1-zone model

Research – starting points fire and smoke



Sprinkler activation Sylvania

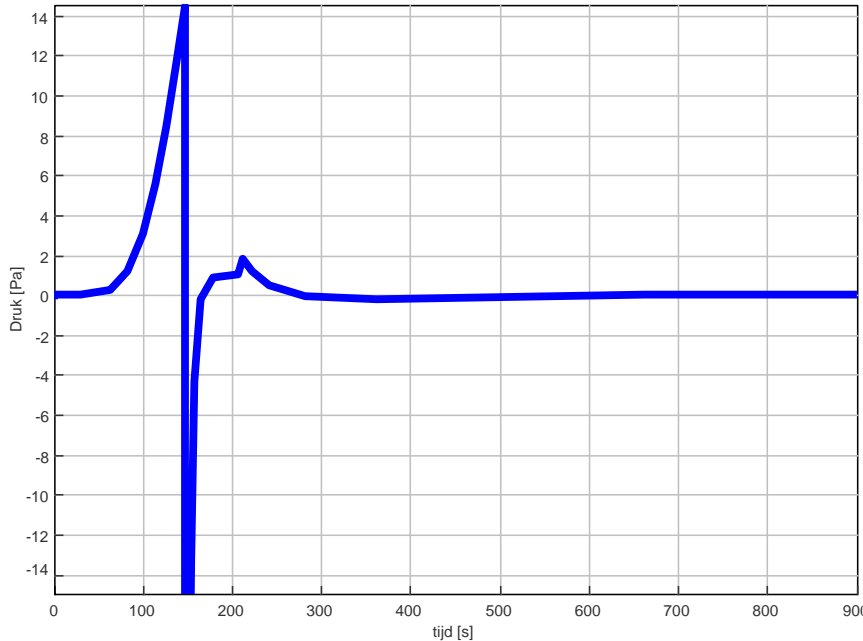
Calculation:
Average
temperature
smoke



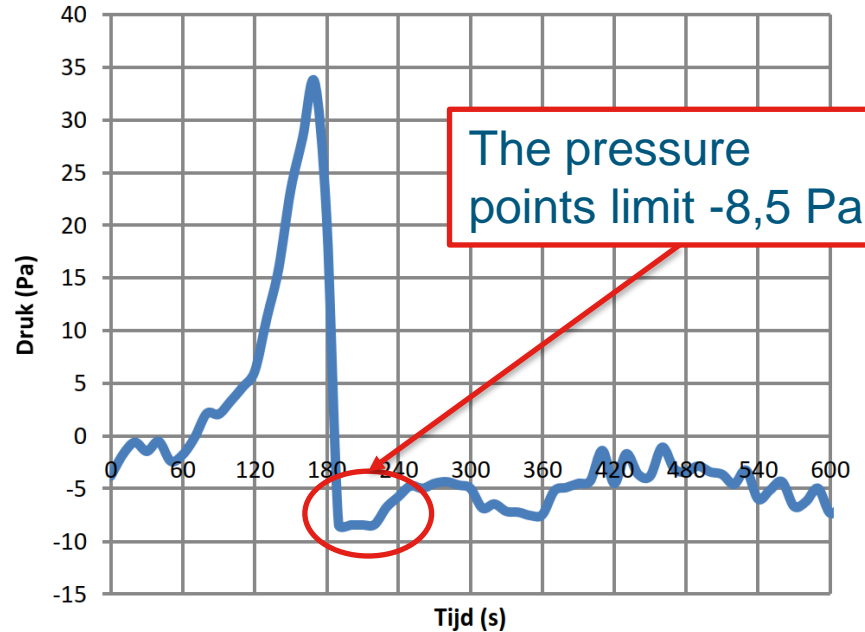
First results verification – comparison VIPA live tests

Pressure difference

Result calculation



VIPA test sprinkler (4bis)

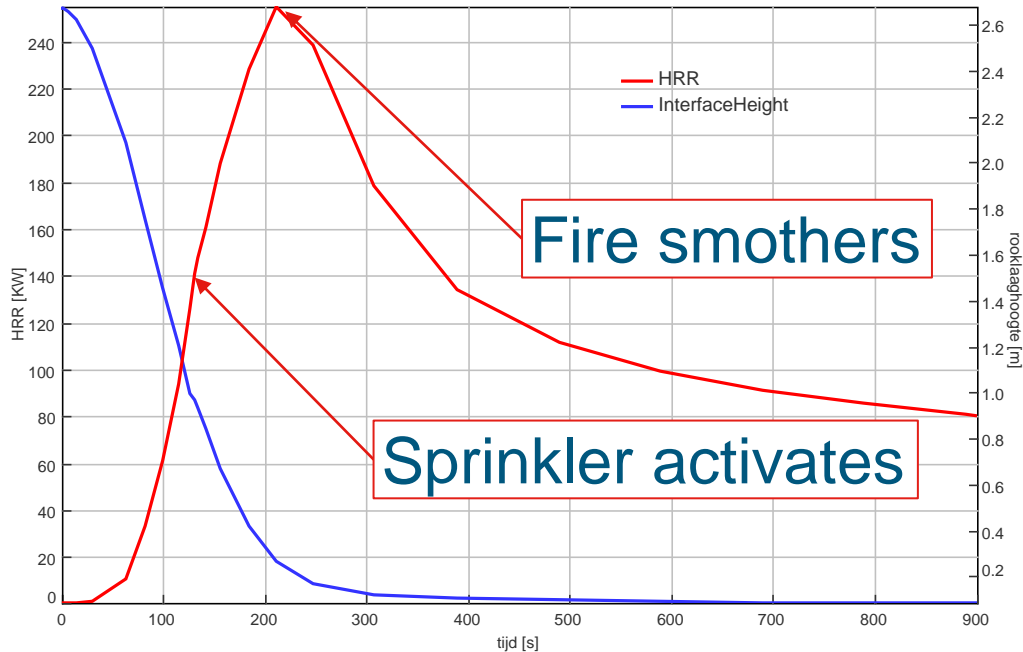


EXOVA WFRGENT + Universiteit Gent

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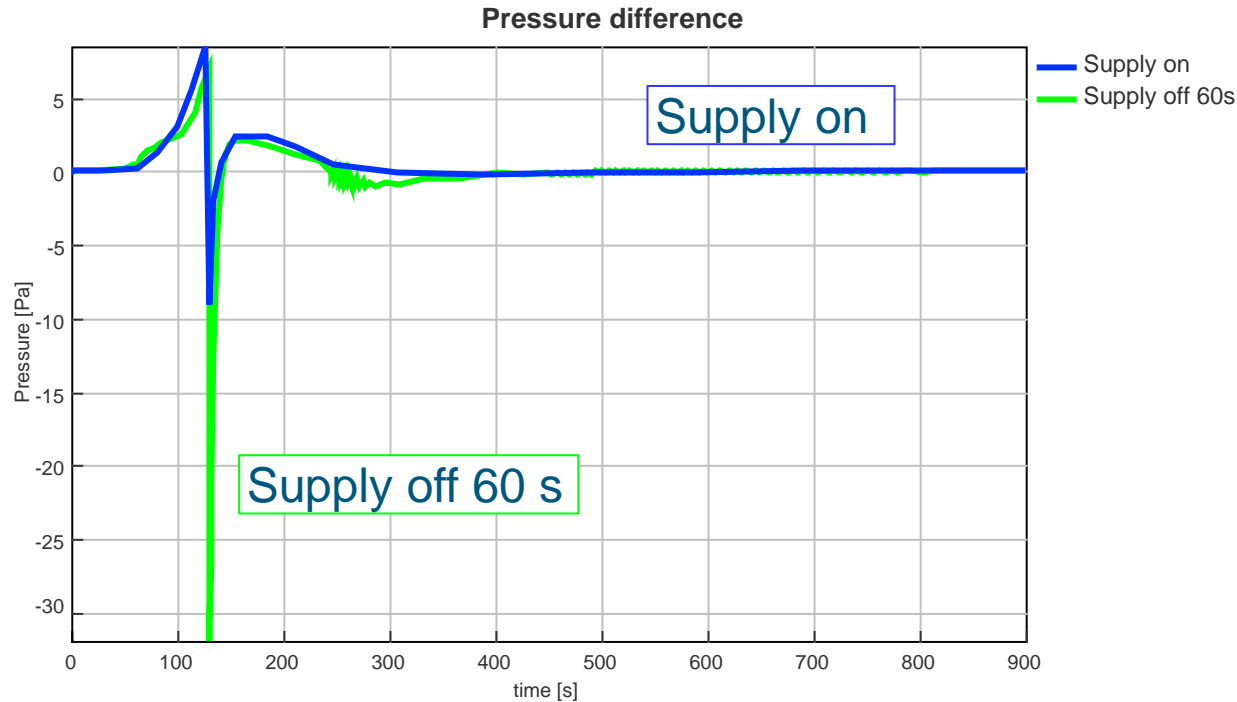
Results Basic model fire and smoke

HRR and smoke layer height



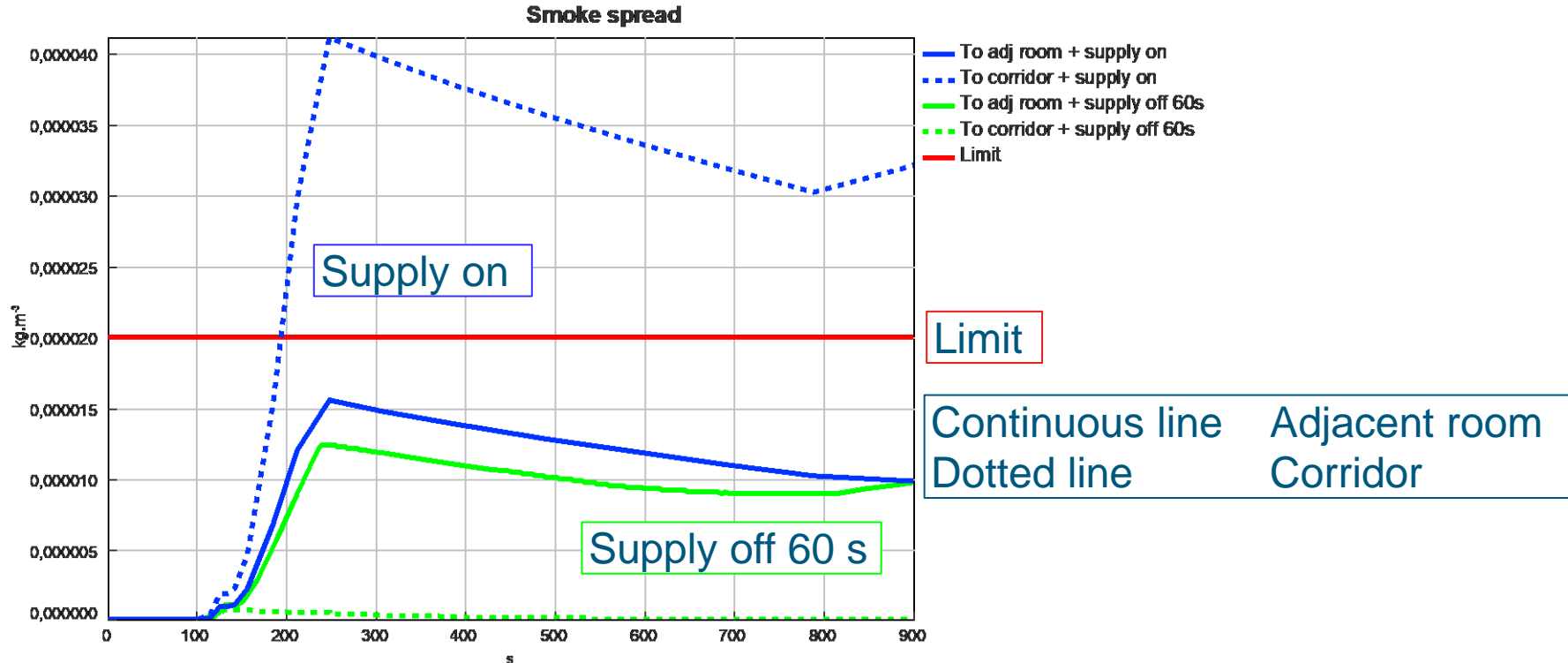
Results Basic model pressure

Variation supply shut off



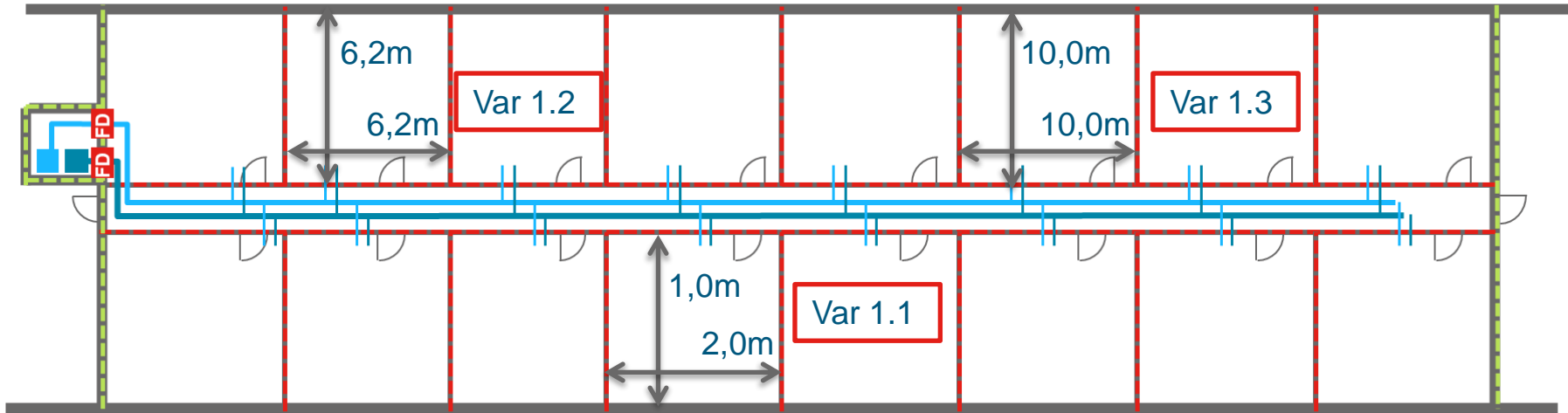
Results Basic model smoke spread (concentration)

Variation supply shut off



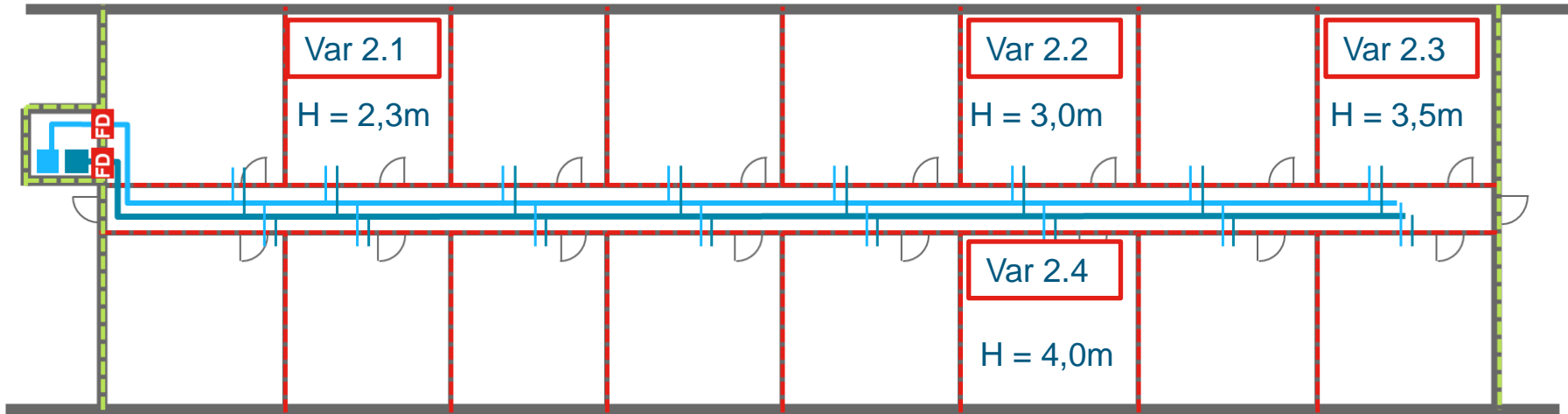
Sensitivity study – reliability and scope variations

Area of the room



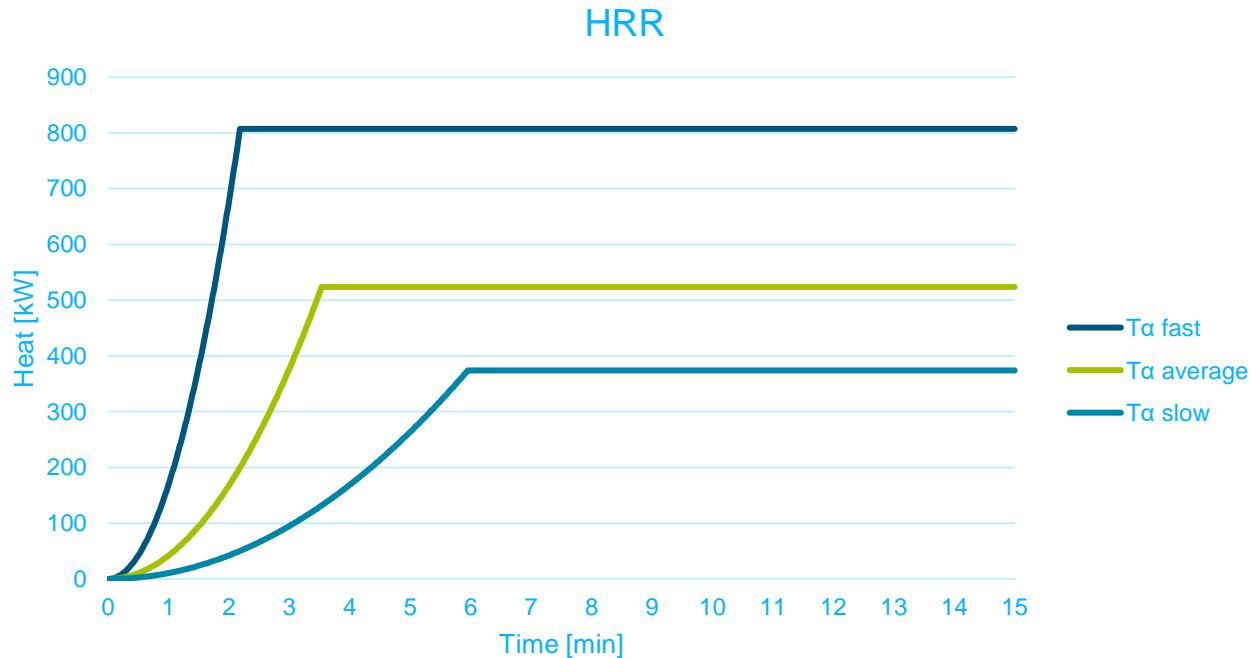
Sensitivity study – reliability and scope variations

Height of the room



Sensitivity study – reliability and scope variations

Fire growth rate



Sensitivity study – reliability and scope variations

Type of fire/ smoke production

Benzene fire

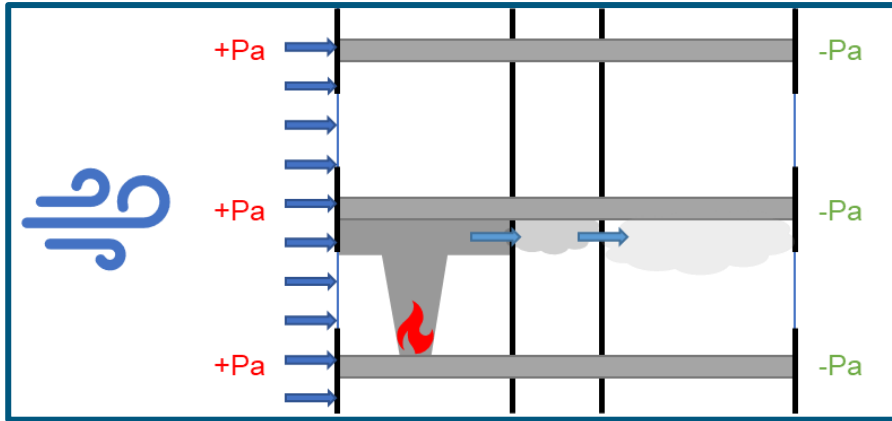


Wood fire

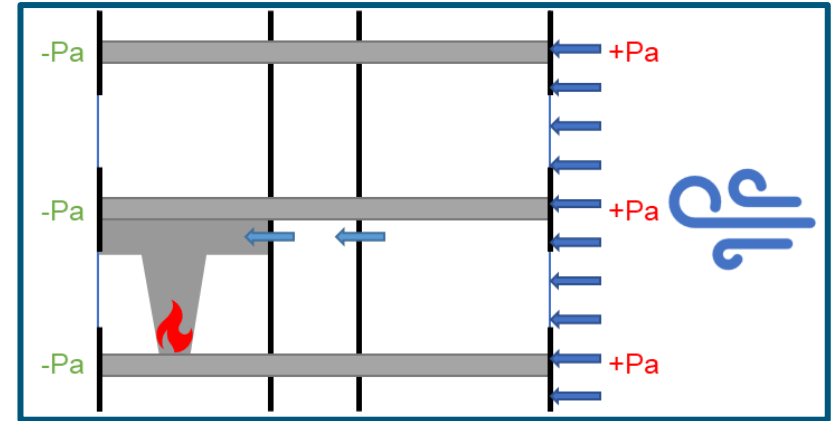


Sensitivity study – reliability and scope variations

Influence wind

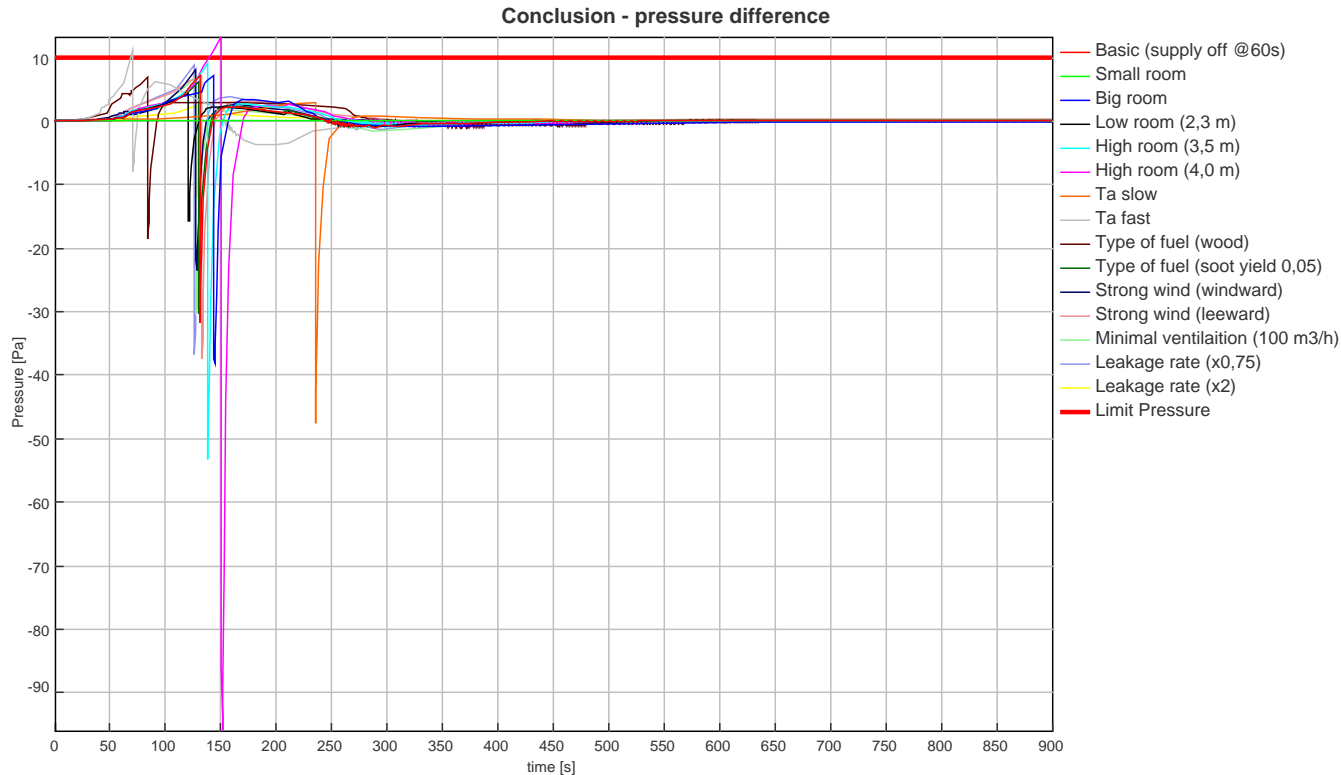


Windward side

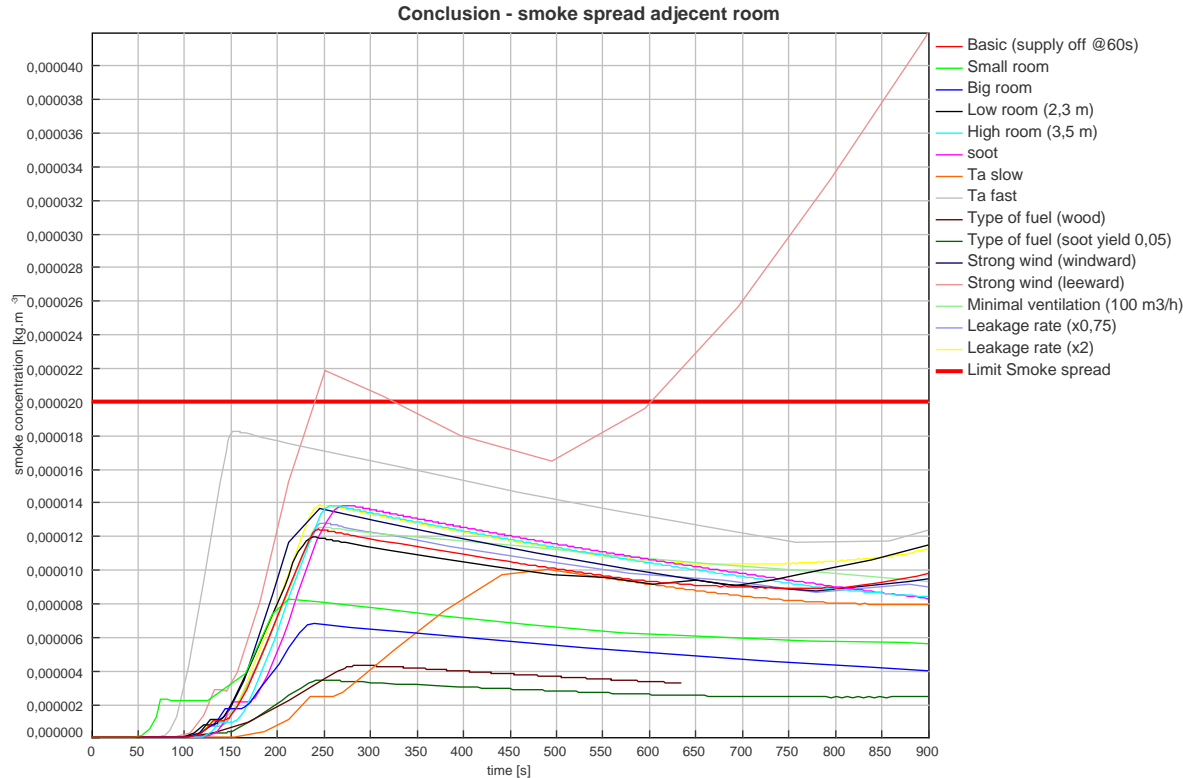


Leeward side

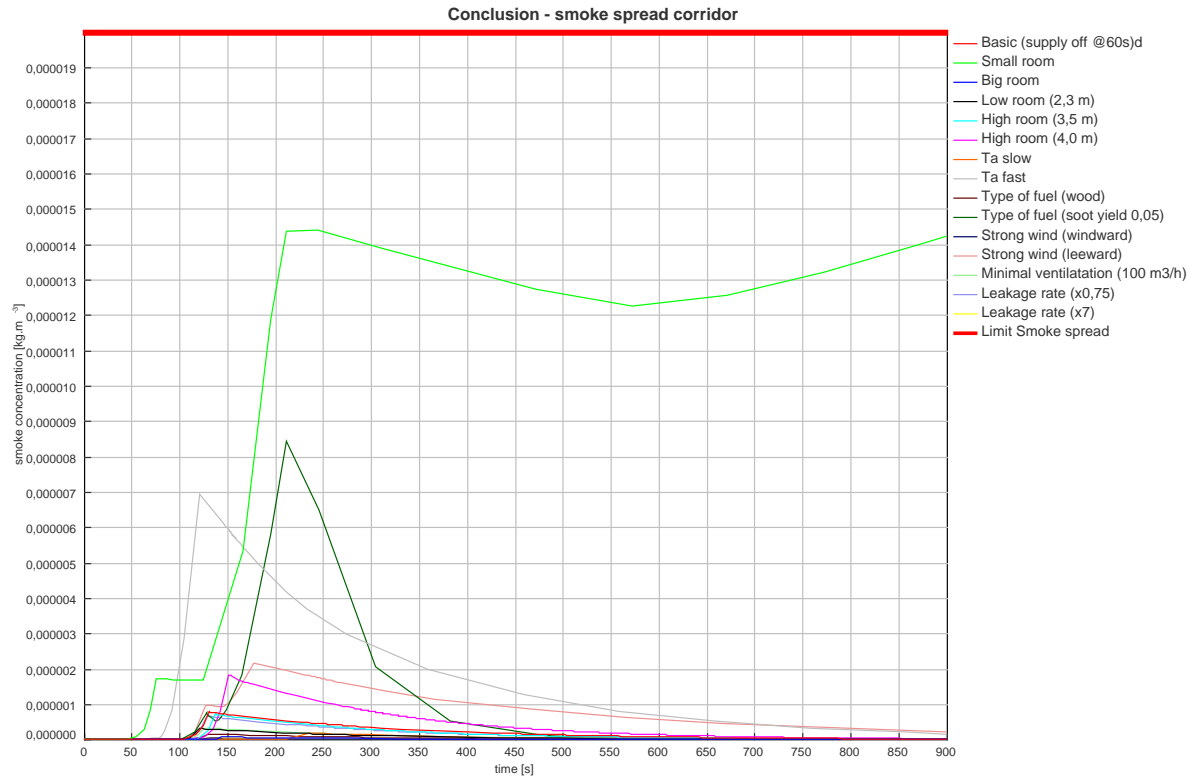
Conclusion – pressure difference



Conclusion – smoke spread adjacent room



Conclusion – smoke spread corridor



Conclusion

Version	Criteria			
	$\Delta P < 10 \text{ Pa}$	$SC \leq 2,0 \times 10^{-5} \text{ kg/m}^3$		$T \leq 200 \text{ }^\circ\text{C}$ (max 66 °C)
		Adjacent room	Corridor	
Small room	OK	OK	OK	OK
Big room (max 6,9 m x 6,9 m)	OK	OK	OK	OK
Low room (2,3 m)	OK	OK	OK	OK
High room (3,5 m)	OK	OK	OK	OK
High room (4,0 m)	Fail	OK	OK	OK
T α slow	OK	OK	OK	OK
T α fast	Fail	OK	OK	OK
Type of fuel (wood)	OK	OK	OK	OK
Type of fuel (soot yield)	OK	OK	OK	OK
Strong wind	OK	Fail	OK	OK
Minimal capacity ventilation	OK	OK	OK	OK
Leakage rate x 0,75	OK	OK	OK	OK
Leakage rate x 2	OK	OK	OK	OK

Questions

