

# Objective based Fire Prevention

## FSS congress: Understanding fires

Lieuwe de Witte

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## Introduction

### **Nieman consulting engineers:**

Fire safety consultant/engineer (12 yrs)  
Researcher

### **IFV:**

Guest lecturer FSE training

### **RGD:**

Fire safety consultant (2007-2011)

*'Safety is the conscious experience of risks'*



Rule based



In 't Hart van de Bouw

## Fire Prevention (rule based)

Rule based public objectives (building act):

1. Preventing casualties by fire
2. Preventing fire damage to third parties (adjacent parcels)

Private objectives not part of building act:

- Preventing material and immaterial damage
- Preventing social damage

Preventive requirements in building code (2012):

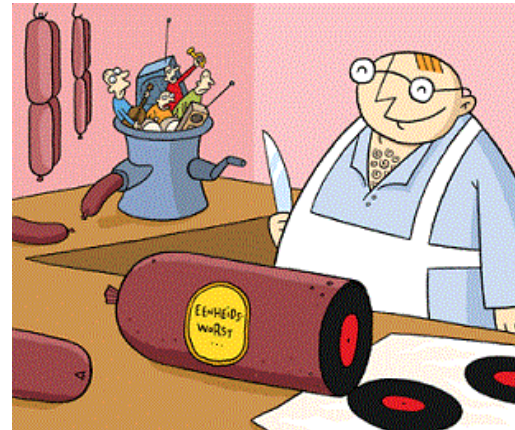
- Rules for a sufficient level of fire safety
- No explicit objectives
- Safety consequences are different for each building
- Ideal building users



## Fire Prevention

### Rules or objectives?

- Sometimes rules are not sufficient
- Sometimes rules may lead to unnecessary measures
- Rules obstruct innovation and tailor-made fire safety



Objectives are more important than rules!

# Objective based Fire Safety

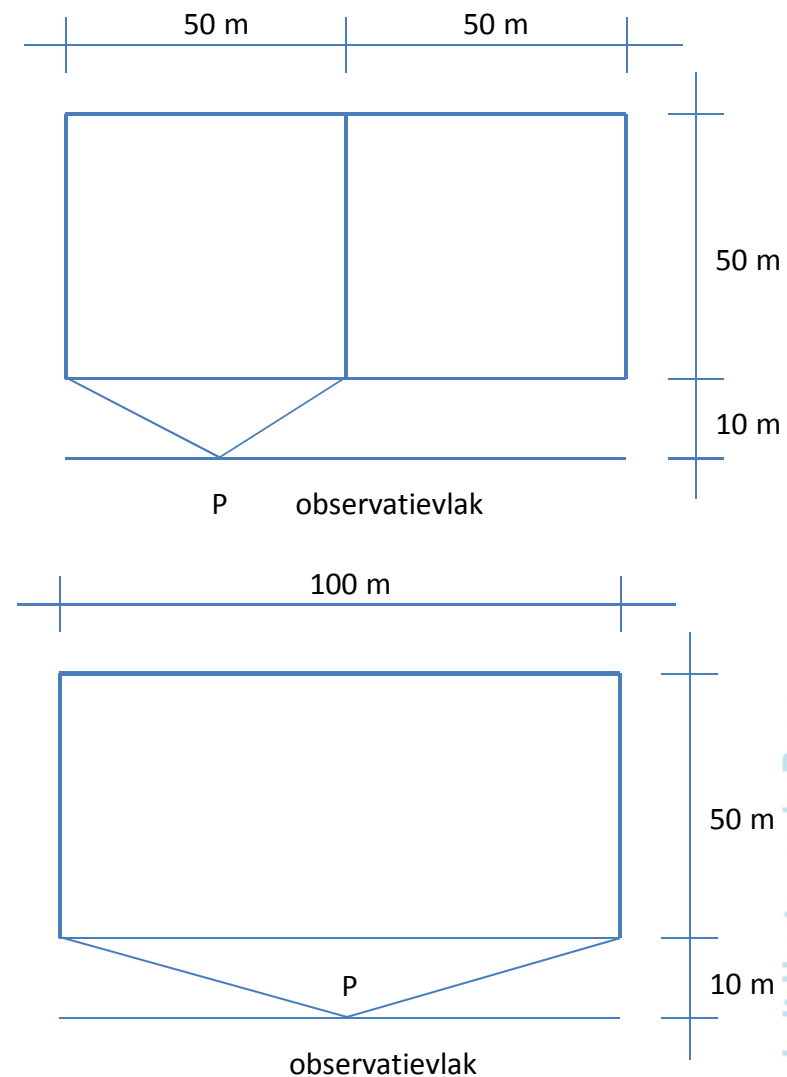
The objectives of the public safety rules (building code):

- Safety environment
- Safety building (structure)
- Safety compartments (spread of fire and smoke)
- Safety escape route
- Safety attack route

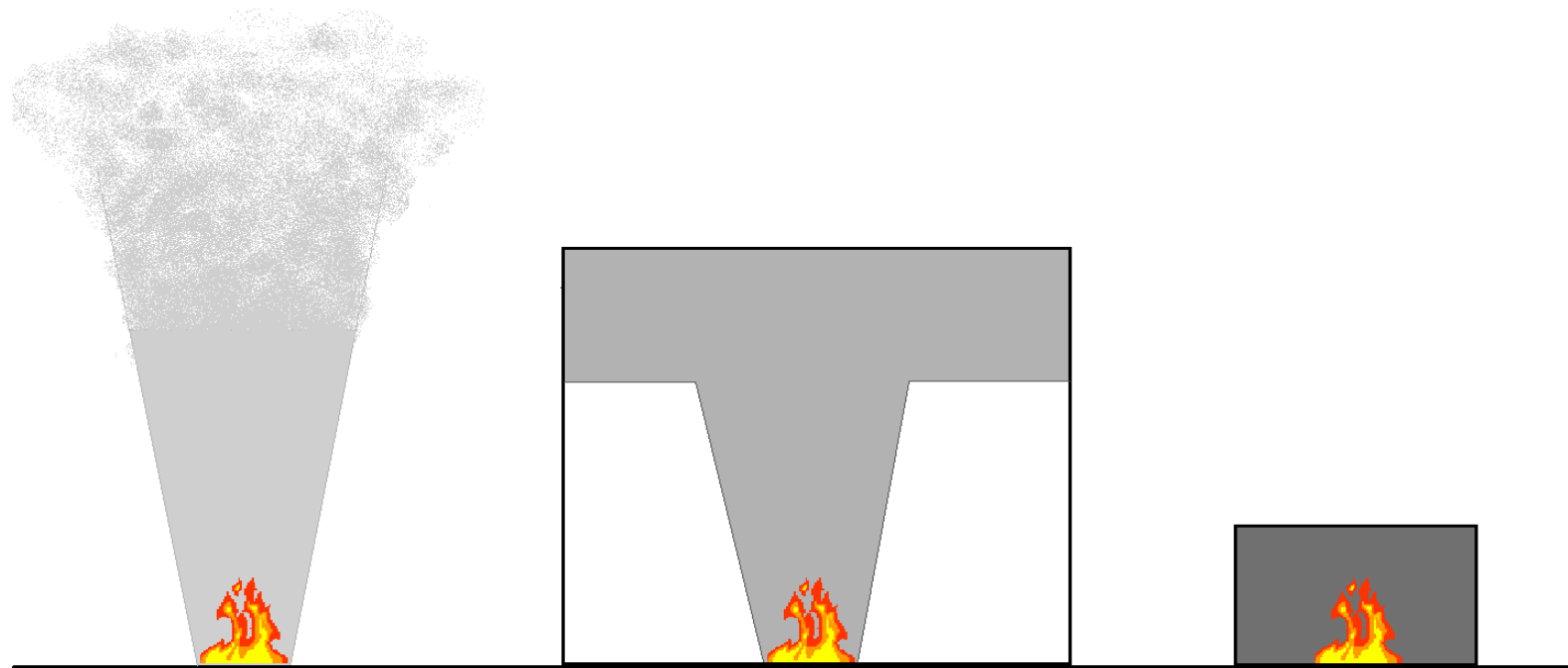
Quantification safety:

- Objectives contain failure risks (probabilities)
- Risk = (safety)<sup>-1</sup>

No clear limits voor risk acceptance



Example precondition building

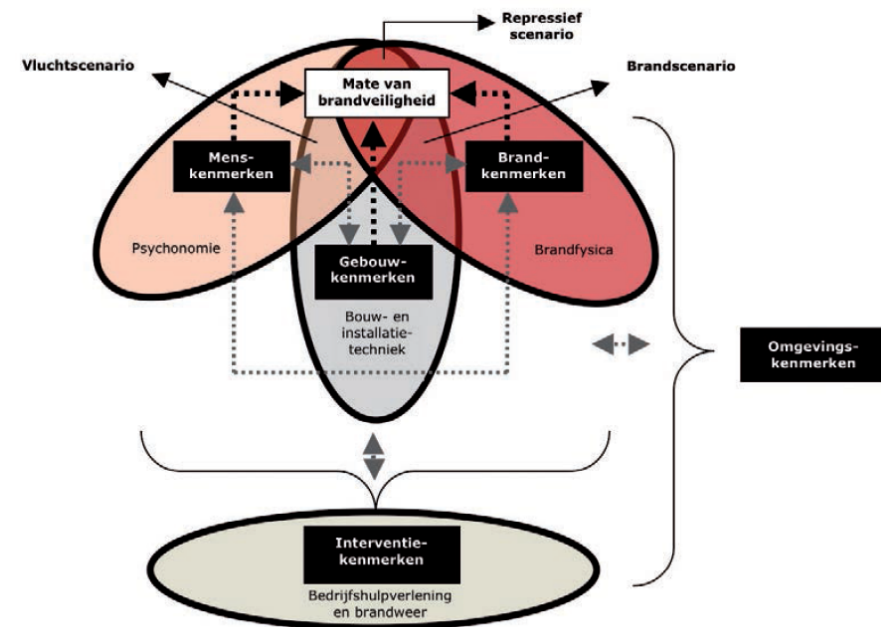
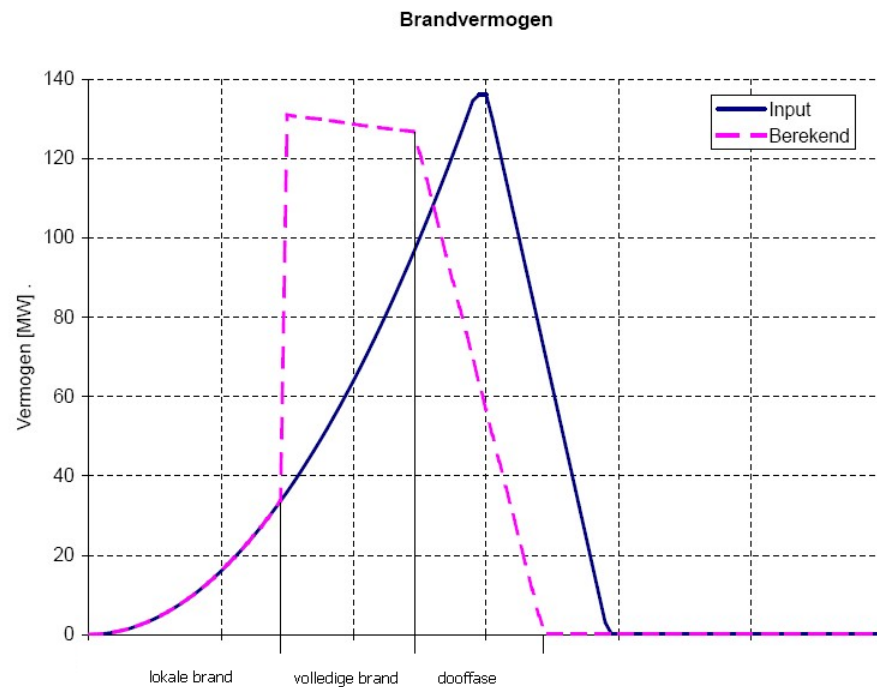


	← Safety environment →	
dangerous		not dangerous
	← Safety escape route →	
not dangerous		dangerous

# Objective based Fire Safety

## Subdivision:

- Natural fire concept (project specific);
- Risk approach (generic/partial project specific);
- Combination of both (project specific).

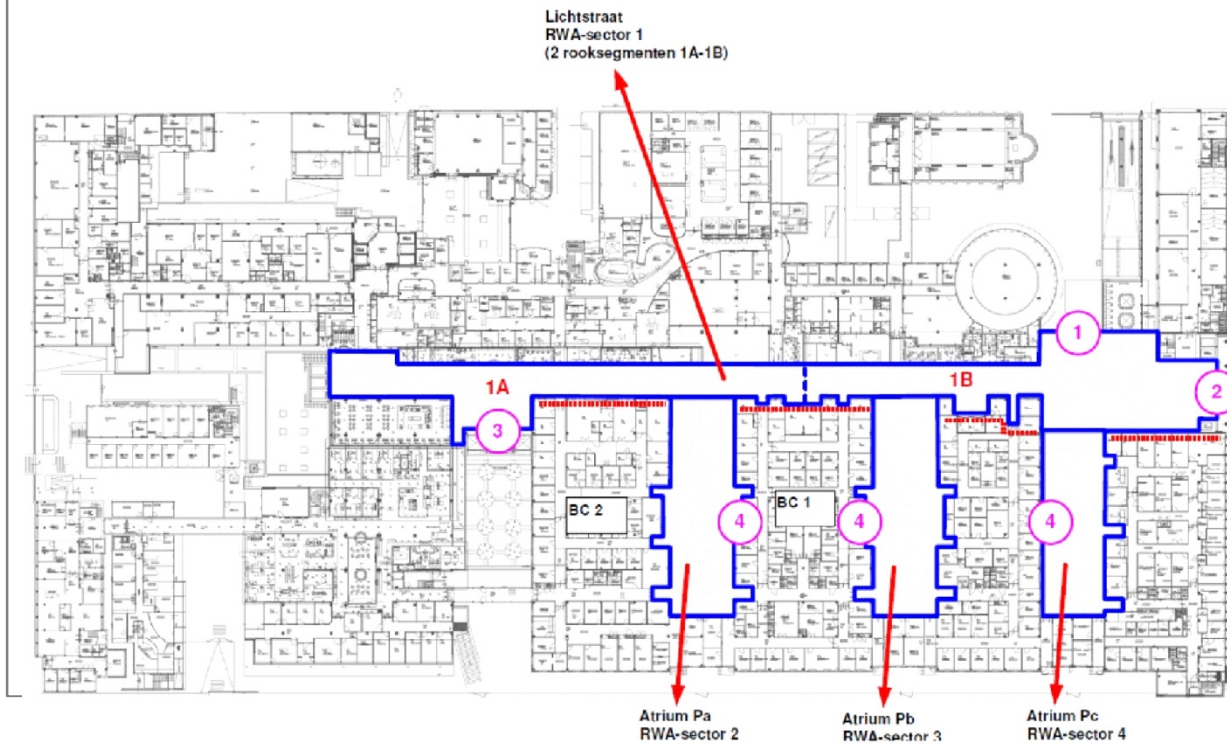




# Example Natural Fire Concept

## Onze Lieve Vrouwen Gasthuis Amsterdam

- Poli squares equipped with smoke and heat exhaust ventilation.
- Facades insufficient fire resistant SBK.



# Example Natural Fire Concept

Poliplein in de buitenlucht

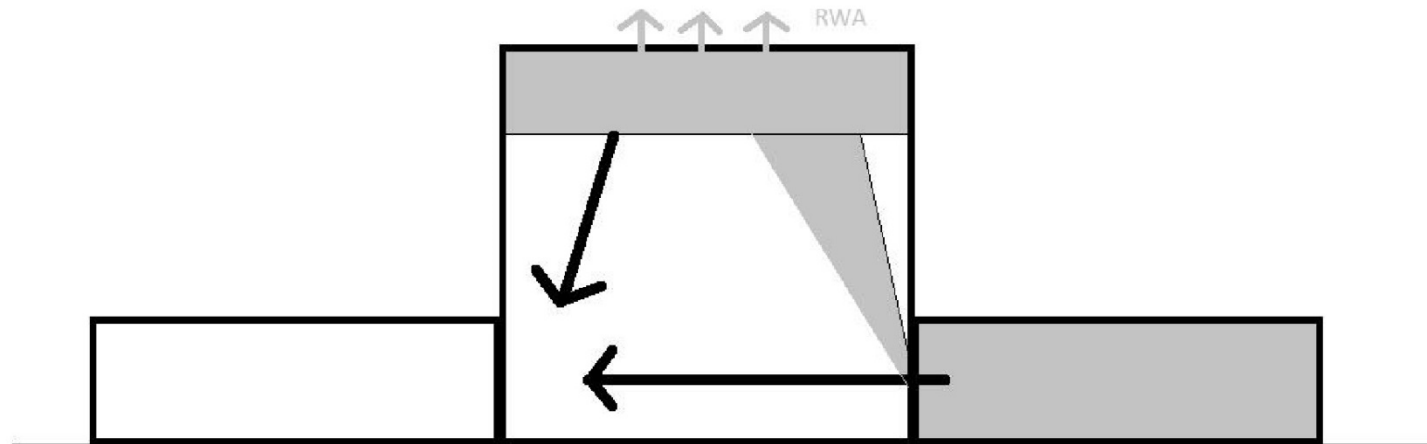
Poliplein met standaard verdiepingshoogte



Buitenlucht met oneindige buffercapaciteit:  
WBO (brandoverslag door straling)

Brandcompartiment zonder buffercapaciteit:  
WBD (brandwerendheid)

Poliplein als grote hoge ruimte



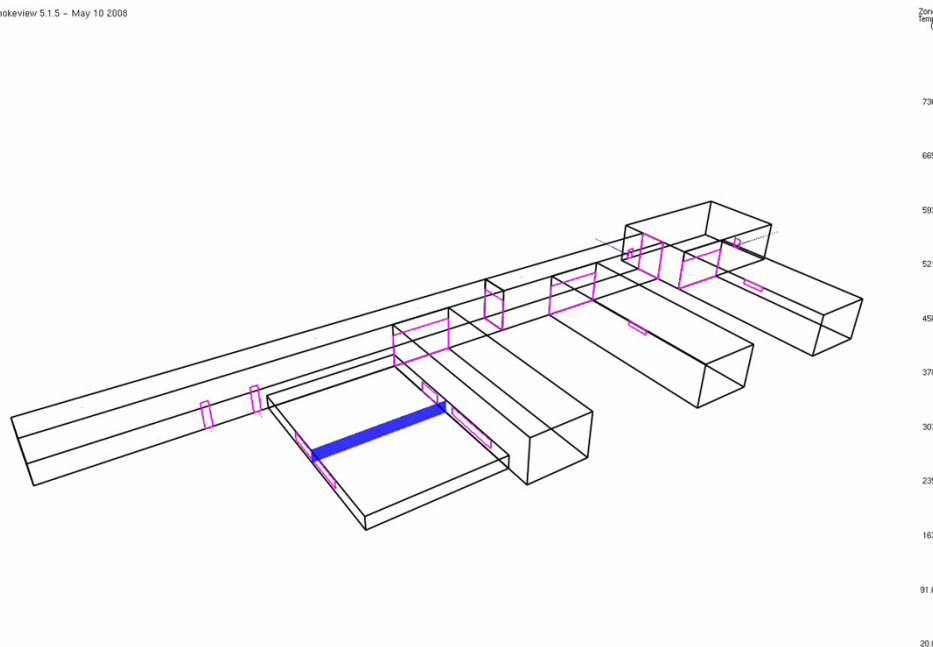
Grote ruimte met gelimiteerde buffercapaciteit:  
 $WBDBO = \text{brandwerendheid WBD} +$   
 buffercapaciteit ruimtevolume

# Example Natural Fire Concept

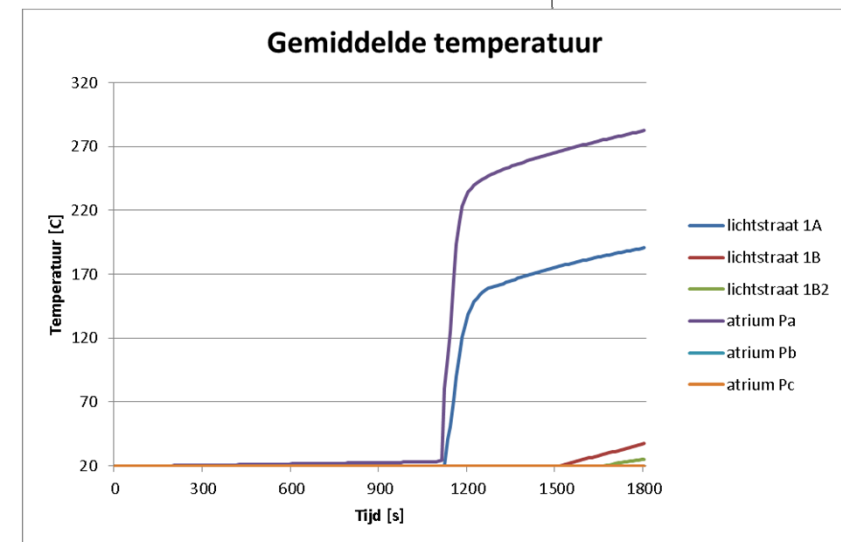
## Objectives:

- Safety compartments (flashover conditions).
- Safety escape routes (safe escape conditions).

Smokeview 5.1.5 - May 10 2008



Frame: 0  
Time: 0.0



# Risk approach (example)

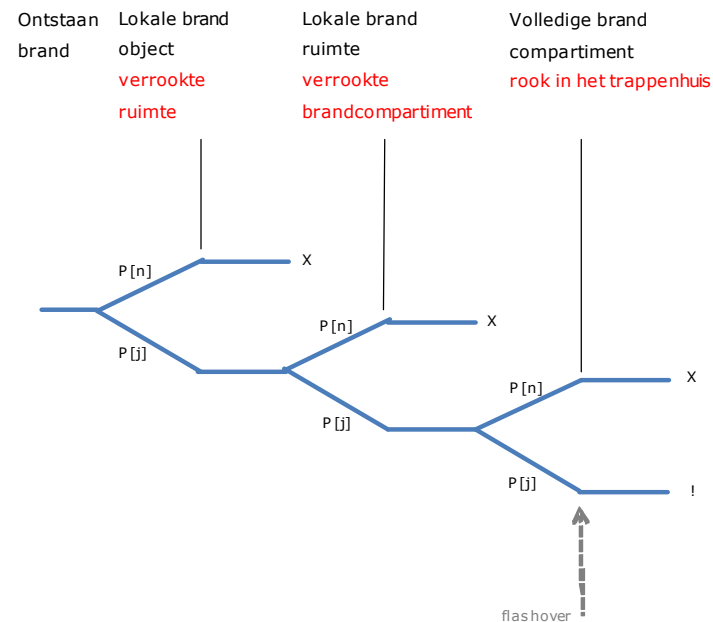
## Objectives:

- Safety compartments (smoke spread)
- Safety escape routes (probability of smoke)

## Risk approach:

- Probability of an effect
  - Unknown probabilities
  - Of the origin of fire (1)
- Comparison with probabilities rule based
  - Reference
  - No real probability factor

## Generic approach



Situatie	Faalkans per fase [%]			Kansfactor [-]
	Fase 1	Fase 2	Fase 3	
Referentie	90	90	50	0,405
Werkelijk met rookmelder gestuurde deurdrangers	90	90	20	0,162
Werkelijk met woningsprinklers	90	20	90	0,162
Werkelijk met rookmelder gestuurde deurdrangers en woningsprinklers	90	20	20	0,036



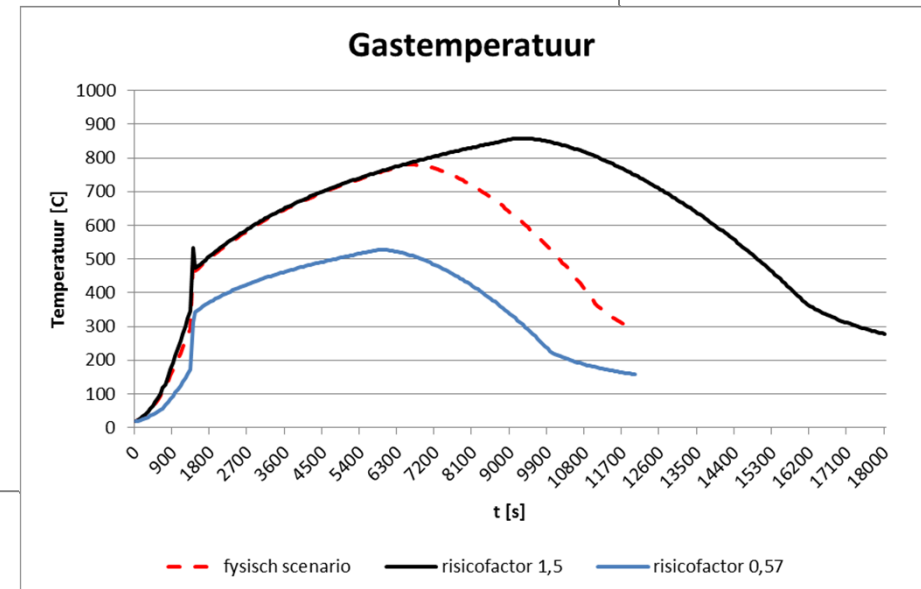
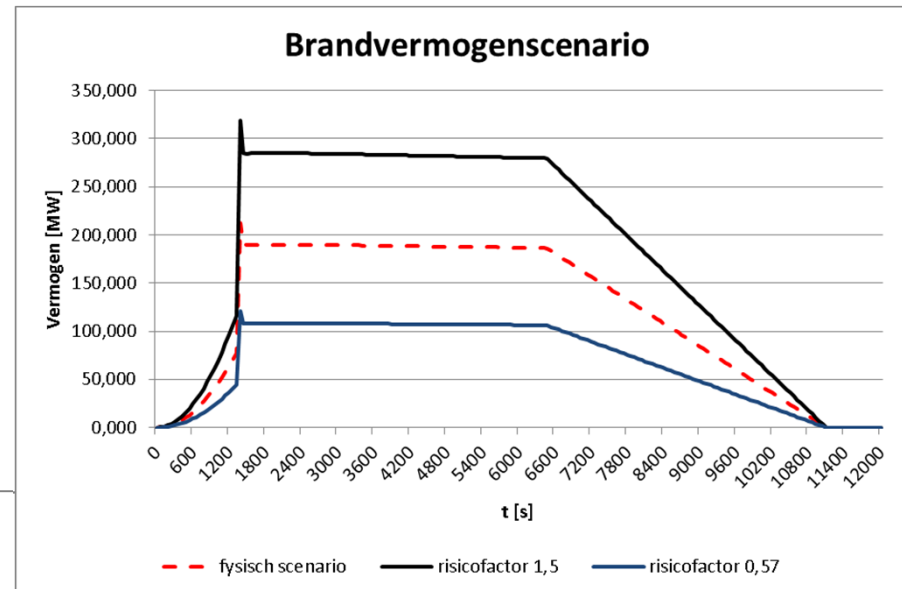
# Combination NFC and Risk approach

## Project specific:

- Value active fire protection in NFC
- Determining time interval between probability origin of fire and flashover

## Consequence:

- Tailor-made measures with optimal fire safety



# Reliability

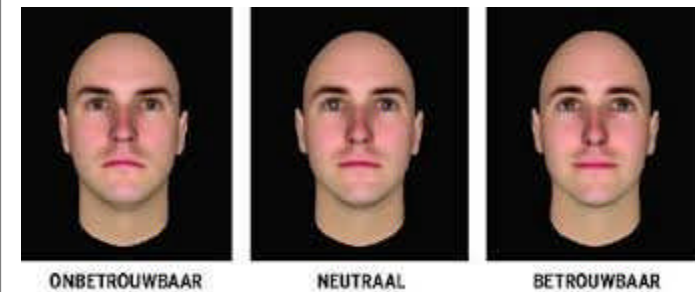
## Rule based:

- Generic review leads to false sense of reliability
- reliability unknown

## Fire safety objectives:

- Good link with rule based objectives (reference)
- Natural fire concept:
  - Robust principles
  - Sensitivity analysis
  - Based on standard deviation

Workshop Reliability of fire safety objectives



## Summary

- Objectives are more important than rules
- Objective based on public safety rules (sub-objectives)
- Ways of objective based fire safety
  - Natural fire concept
  - Risk approach
  - Combination
- Tailor-made measures with optimal fire safety
- Reliability of fire safety objectives

