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DYNAMIC MODELLING OF FIRE EFFECTS

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INTRODUCTION

Mohammad Seyfi, MSc., CFPS

Industrial Fire Safety Specialist

MSc. International master of science in fire safety engineering (IMFSE)
NFPA certified fire protection specialist (CFPS)

Main fields of work:

- Fire Hazard Assessment
- Fire Modelling
- Prescriptive/ Performance-Based Fire Analysis

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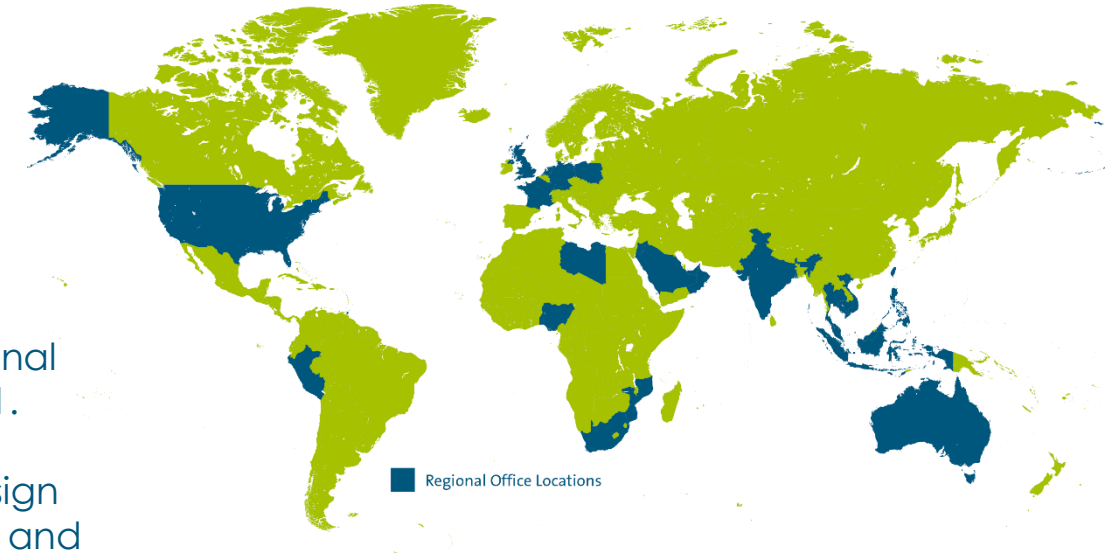

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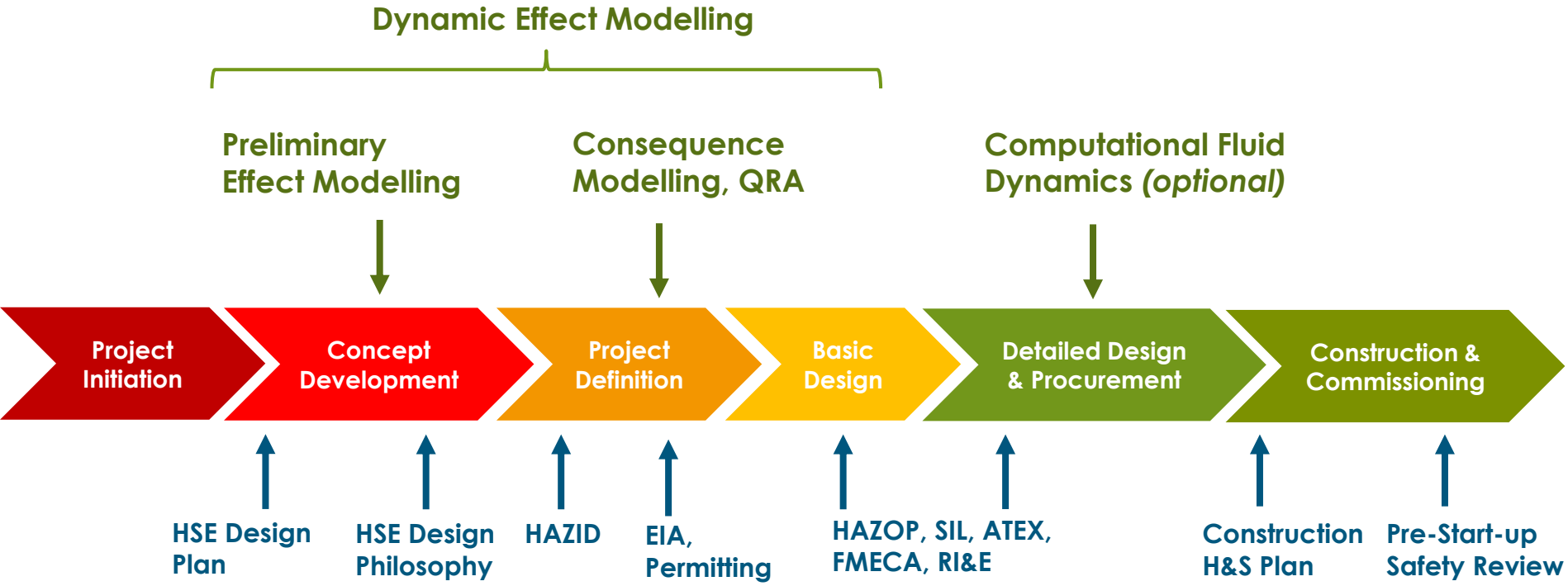

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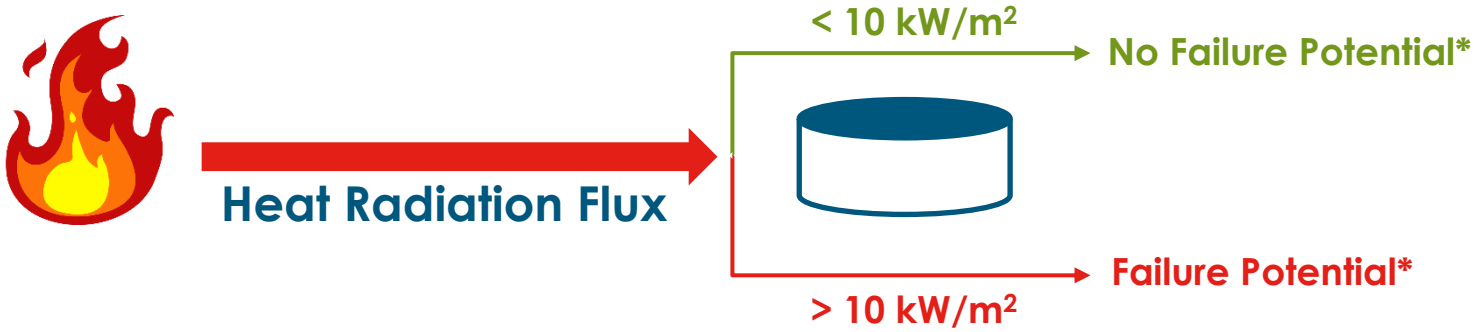
CONVENTIONAL FIRE EFFECT MODELLING

- Fire effects (heat radiation) approximated conservatively
- Modelling based on fixed heat radiation flux
- Failure criteria based on fixed thresholds



* Depending on type of installation other thresholds may be considered

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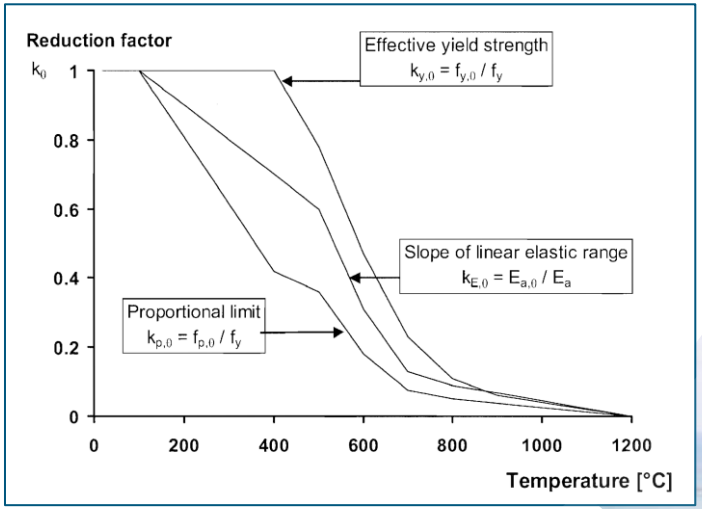
ACTUAL FAILURE MECHANISM

- No abrupt failure, rather a gradual influence on exposed installation by:
  - Material strength reduction
  - Vapor pressure increase > Flash Point
  - Temperature increase > Auto Ignition Temp.
  - …

Thermal load (dose) =

Thermal Radiation Flux ∗

Impacted Area ∗ Time



Reference: EN 1993-1-2:2005 Eurocode 3

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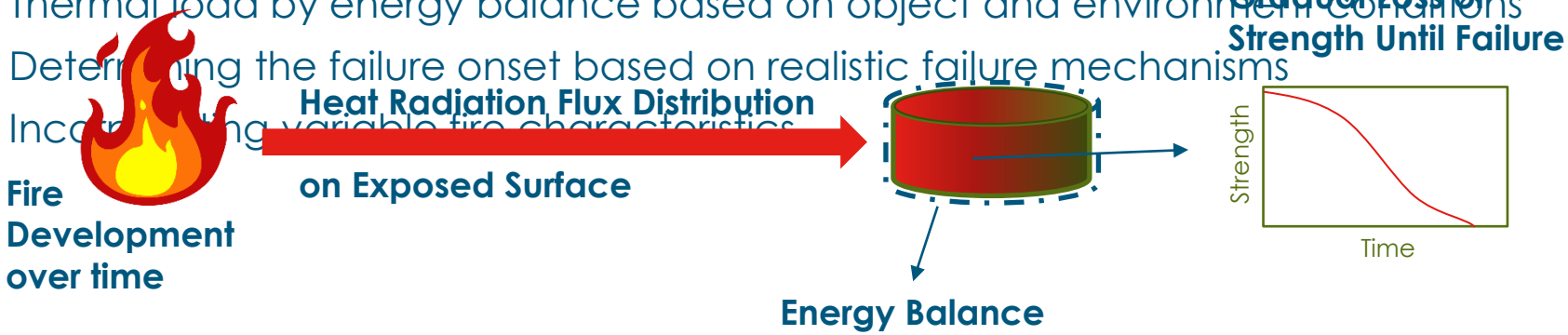
DYNAMIC DOSE-BASED FIRE EFFECT MODELLING

- Distribution of incident heat radiation on the surface of the exposed object
- Thermal load by energy balance based on object and environment conditions
- Determining the failure onset based on realistic failure mechanisms
- Incorporating variable fire characteristics



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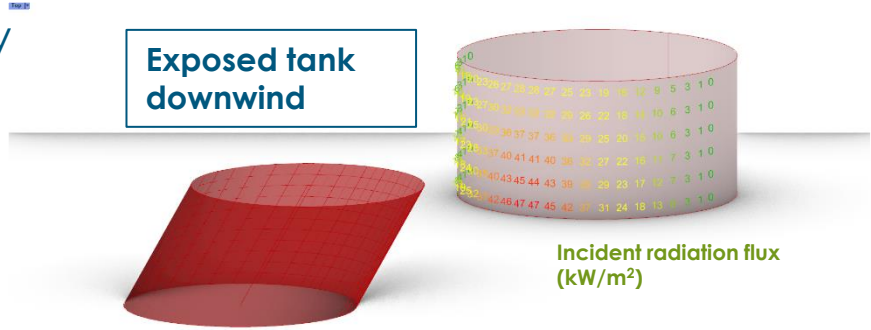
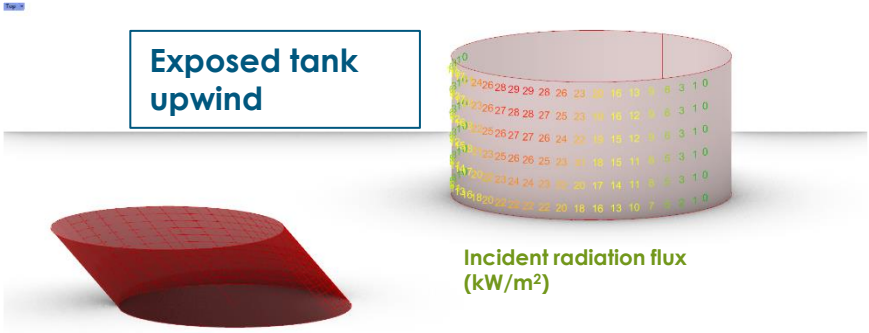
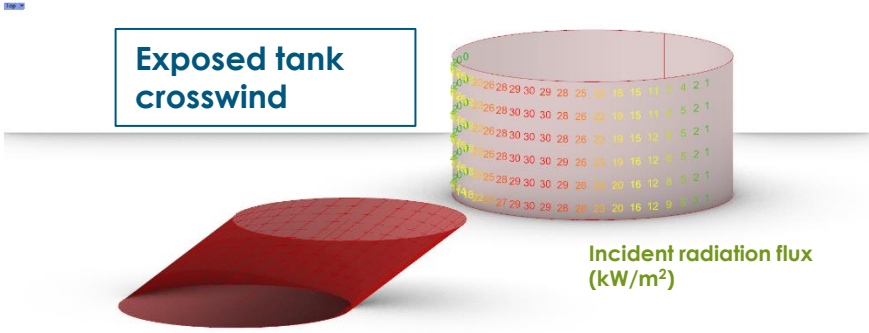
EXAMPLE MODEL FOR DYNAMIC FIRE EFFECTS

- View factor by computational geometry
- Quick adjustment of results by parametric modelling







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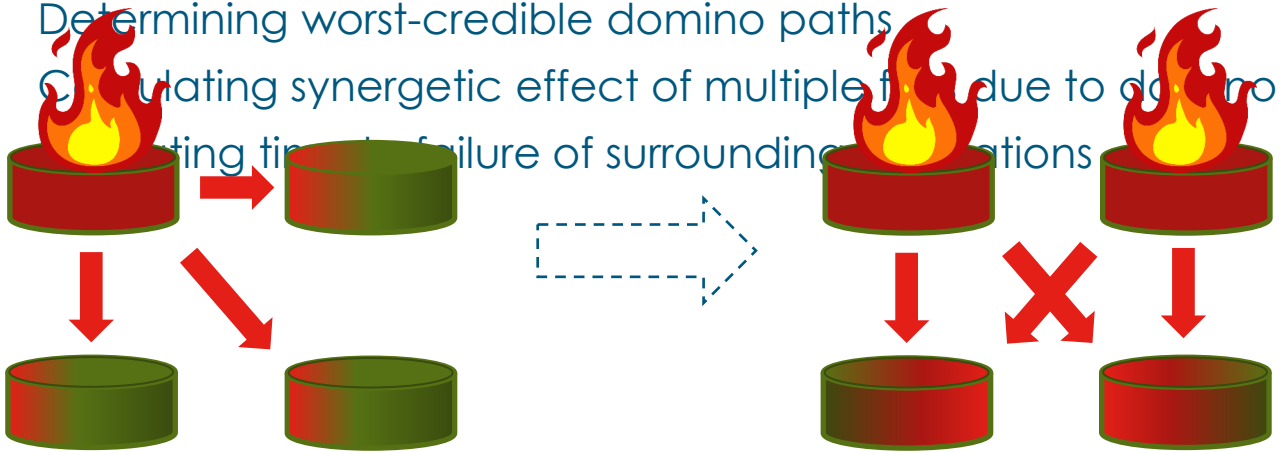
DYNAMIC FIRE EFFECT MODELLING CAPABILITIES

Dynamic domino effect assessment in early design phase:

- Determining worst-credible domino paths
- Calculating synergetic effect of multiple fires due to domino effect
- Estimating time to failure of surrounding installations



DYNAMIC FIRE EFFECT MODELLING CAPABILITIES

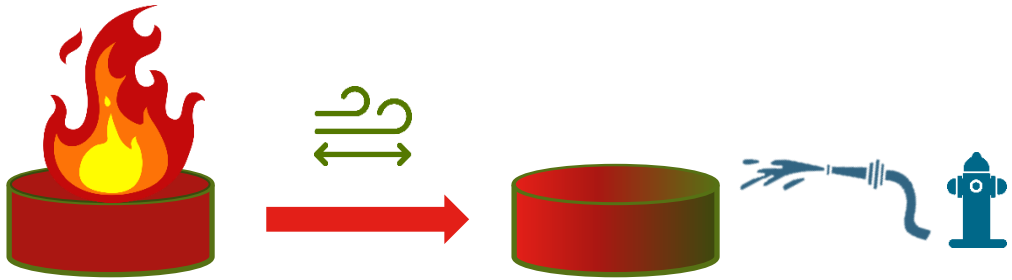
Performance-based optimization of passive and active fire protection:

- Estimating the minimum fireproofing required per region
- Determining the suitable location, size and characteristics of firewall
- Determining minimum cooling water application per region
- Determining suitable characteristics of water curtains

DYNAMIC FIRE EFFECT MODELLING CAPABILITIES

Pre-incident planning for fire brigade operation:

- Estimating available time to perform firefighting actions before failure
- Estimating required firefighting resources based on weather conditions



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DYNAMIC FIRE EFFECT MODELLING CAPABILITIES

Summary:

- Quick and detailed fire effect modelling in early project phase
- Dynamic domino effect assessment
- Performance-based optimization of fire protection (passive & active)
- Improved pre-incident planning for fire brigade operation

In other words:
Detailed fire safety assessment at early stages of new and modification projects and reduced time / cost investment compared to CFD modelling

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THANK YOU FOR YOUR ATTENTION

For more information, please find us at RHDHV booth or contact us via email or our website

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