



Content of presentation



- Performance based design fire safety design?
- Performance based design fire safety design and water mist systems?
- Conclusions



Performance based fire safety design?

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Performance based fire safety design?



“it’s expensive“

„who can do“

“avoiding approvals“

“delays everything“

“combines all systems – yes please“

“bad way of doing things“

“novec is the best“

“cost saving“

“water mist “

“complicated“

“effective“

“does not work with sprinkler systems“

“must be related only to new technologies“



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NFPA Glossary 2021: Performance based design

“A design process whose fire safety solutions are designed to achieve a specified goal for a specified use or application.”

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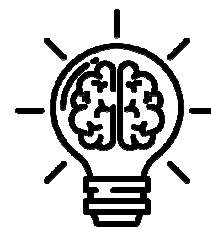
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Prescriptive vs. Performance based



- Prescriptive standards/methods:
 - Traditionally most used in fire protection
 - Gives simple answers for approved solutions for different hazards
- Performance based design:
 - Alternative way that takes account project related hazards and technical solutions



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Prescriptive design methodology



- Pros:
 - Formally accepted for standard risks
 - Systems are available “off shelf” by manufacturers
- Cons:
 - Applicability with new hazards is questionable
 - Typical reaction time is minimum 3 years
 - Only provide protection for events that have happened
 - Suppresses innovation
 - Not flexible for the construction or application



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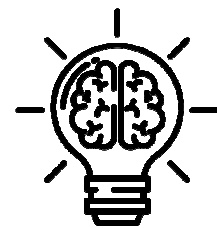
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Performance based design methodology



- Pros:
 - Testing specific for the each project or design scenario
 - Construction cost saving
 - Compensation of other fire safety measures
 - Testing multiple systems to see find best solution
- Cons:
 - Costly
 - Requires extra time
 - Validation possibilities are more limited
 - E.g. only accredited laboratories
 - Experienced designers (simulation competence)
 - AHJs have to do more work



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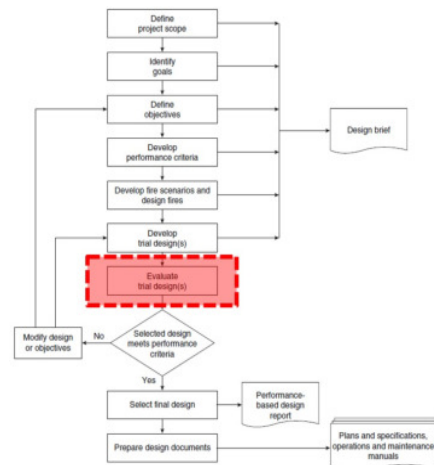
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Performance based design methodology

IFAB

- There are many different models
 - NFPA, SFPE, National, other industries, etc.
- Main steps (IFAB):
 1. Define safety objectives
 2. Develop performance criteria
 3. Develop design (systems)
 - 4. Validate**
 5. Document or revise



SFPE 2021

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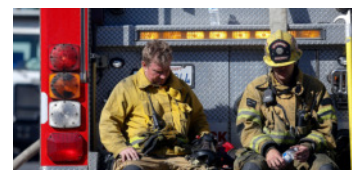
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Performance based design methodology

IFAB

1. Define safety objectives:

- Typically qualitative
- Options:
 - Life safety
 - Safety of emergency personnel
 - Structure protection
 - Others:
 - Business continuity (e.g. local protection)
 - Explosion prevention
 - Etc.



Note! Prescriptive design methods do not consider “specialities”

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Performance based design methodology



2. Develop performance criteria:

- Quantitative
 - hazards / boundary conditions
- Test protocol
 - Design fire scenarios
 - Measurement system
 - Pass / fail criteria

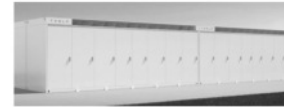
3. Develop system(s)/solution:

- Fire detection
- Fire fighting
- Smoke extraction
- Etc.



Fire test protocol

For the validation of a high-pressure water mist system for the protection of 2,0MW Energy Storage System (ESS) with NMC lithium-ion batteries



Document number: 20230086 TP
Date: 20/09/2023
Revision: 01 DRAFT

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Performance based design methodology



4. Validate:

- Analytical (engineering)
- Experimental
- Numerical (CFD)

5. Document or revise



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Performance based design methodology



- Relevant stakeholders:
 - Client / owner
 - Designer / consultant
 - Manufacturers / technology providers
 - Test organisations / special designers
 - AHJs / insurers



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Performance based fire safety design and water mist systems?

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Water mist systems



- The question:

Is the performance based design an opportunity for water mist systems?

Answer is **YES**



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Water mist systems



1. Water mist systems are innovative

- “Only“ 30 years old
 - From marine to high number of risks
- Products are innovative
 - Nozzles (pressure, flow rate, spacing, technology)
 - Valves
 - Pumps
 - Hydraulic solutions
- New products easily developed
- Visit exhibition area to see different products!



100 years of sprinklers

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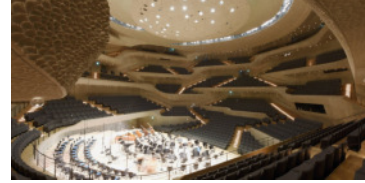
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Water mist systems



2. Water mist is effective for performance based design applications

- Benefits of water mist can be utilised
- Applications:
 - New hazards and more complex buildings
- Especially many new hazards utilise benefits of water mist



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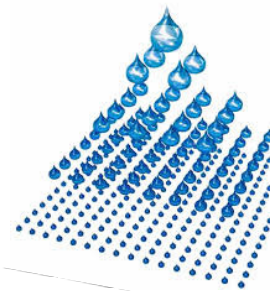
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Water mist systems



3. Water mist is generally accepted

- Water mist technologies are known, also by AHJs.
- Mist systems often represent best practice for many applications:
 - Efficiency and cooling vs. water amounts
 - Sustainable



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Water mist systems



4. Experience with fire tests

- Validation testing is everyday practice for water mist systems
- Many manufacturers have established connections to test laboratories
- Note! No sprinkler equivalency required but solutions can use the real benefits of water mist



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Water mist systems



5. EN14972 – Annex A Guideline for developing representative fire test protocols for water mist systems

- This is an additional benefit for water mist systems to test / document validation



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Conclusions?

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Conclusions



- Performance based design is alternative for prescriptive design methods and standards
- Method applies typically on special and new hazards and individual projects
- Allow individual safety targets and using best practices

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Conclusions



- Validation is extremely important
- Water mist systems are especially suitable for many applications where performance based design is used
- Water mist technology and industry is already well prepared for the typical requirements of performance based design
 - Fire testing, innovative product development, typical hazard type

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Keynote presentation IWMC 2023:

“New challenges require new solutions“

Jakob Vedsted Andersen 11.10.2023

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INSTITUTE FOR APPLIED **FIRE SAFETY RESEARCH**

THANK YOU!