

WATERMIST TURBINES:

EXTENDING THE CAPABILITIES OF WATER MIST SYSTEMS

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FIREFIGHTING

- Mobile Firefighting
- Firefighting Robots
- Stationary Fire Protection



DUST AND ODOR CONTROL



→ The common denominator for all of our customized solutions: **Water Mist.**

Background



Water mist is a well-established extinguishing principle for a broad set of fire scenarios because finely atomized droplets provide a very high heat-transfer surface, promote rapid cooling, reduce radiant heat, and, after evaporation, locally displace oxygen. Turbine-based water mist systems build on the same physical principles but extend their operational envelope: the turbine imparts additional momentum to the spray, increases throw distance, and improves spatial coverage, allowing the mist to envelop objects and to act on partially hidden fire zones. This makes the concept especially relevant for large fire loads, industrial spaces, storage areas, and hazards where throw distance and thermal shielding are critical.

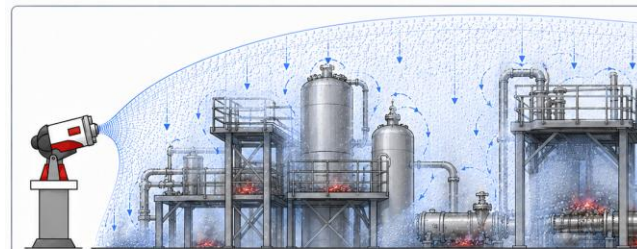
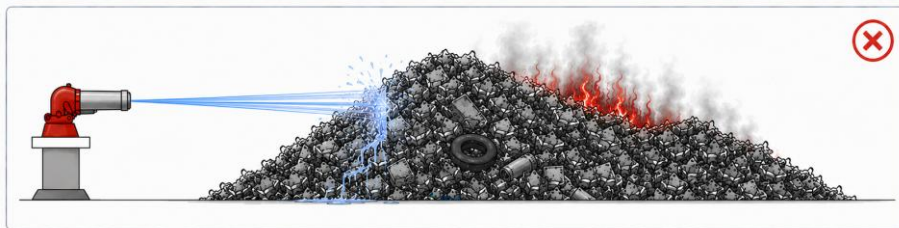
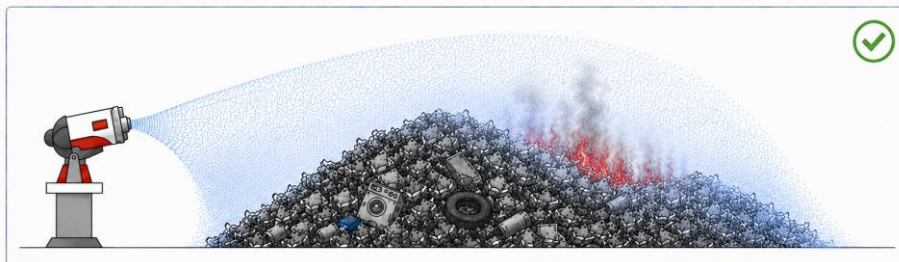




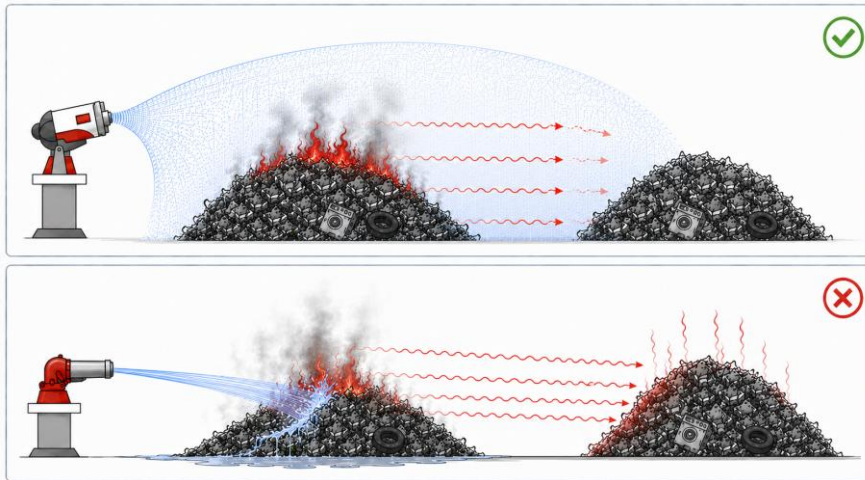
Objective

The objective of this presentation is to show how turbine-generated water mist confirms to be suitable and efficient for large and severe fires, including representative hazards from classes A and F, as well as scenarios in which electric current may be present.

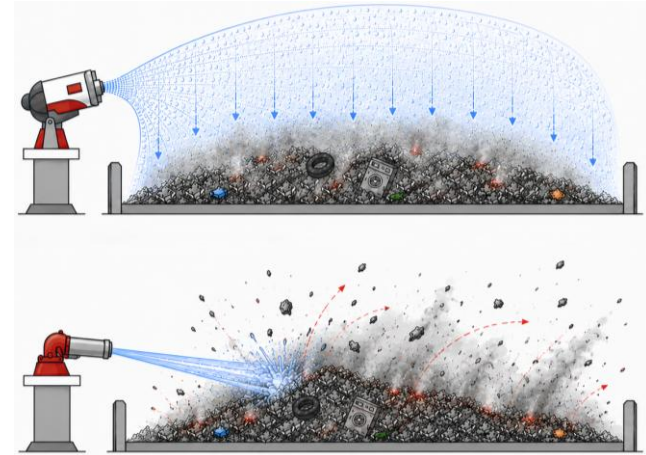
Reach hidden areas



Thermal radiation shield



Gentle and uniform application





Footprint Watermist turbine

30 to 60+ m effective throw distance

Adjustable spray pattern



Method

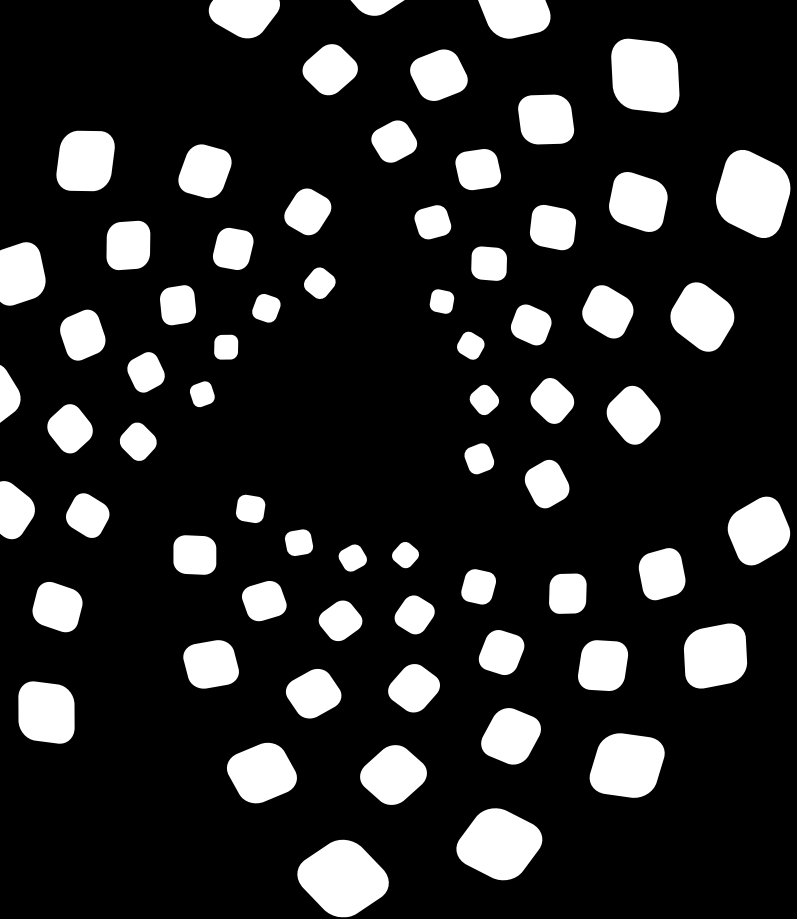


The evaluation approach is based on full-scale real-fire testing under controlled but operationally relevant conditions. Large fire scenarios are organized to measure knockdown behaviour, time to control, time to extinguishment, effective range, and thermal protection performance. These demonstrations were supported or reviewed by independent fire-testing and certification bodies, including CNPP.

Benefits of Water Mist

	Colours						
Types		Fires involving wood, paper, textiles etc.	Fires involving flammable liquids, petrols, spirits etc.	Fires involving flammable gases, butane, propane etc.	Fires involving burning metals, e.g. magnesium	Fires involving electrical equipment	Fires involving cooking oils and fats
Water Mist		✓	✓	✓	✗	✓	✓
Water		✓	✗	✗	✗	✗	✗
Foam		✓	✓	✗	✗	✗	✗
Dry Powder		✓	✓	✓	✗	✓	✗
M28 / L2		✗	✗	✗	✓	✗	✗
Co2		✗	✓	✗	✗	✓	✗
Wet Chemical		✓	✗	✗	✗	✗	✓

Source: IWMA



	Colours						
Types		Fires involving wood, paper, textiles etc.	Fires involving inflammable liquids, petrol, spirits etc.	Fires involving flammable gases, butane, propane etc.	Fires involving burning metals, e.g. magnesium	Fires involving electrical equipment	Fires involving cooking oils and fats

CLASS A FIRE

CNPP REPORT

Scope

Dual objective:

- To measure the capacity of turbines to **extinguish** a large **Class A** fire consisting of wooden pallets.
- To evaluate the heat **shield effect** of the water mist generated by a turbine.

Two turbines used:

A model FT40 fire **extinguishing turbine**, directed at the fire from varying distances (25 m, 45 m, 50 m depending on the test).

A model TAF35C **"screen" turbine** mounted, positioned laterally to create a screen of water mist without attacking the fire.

Setting



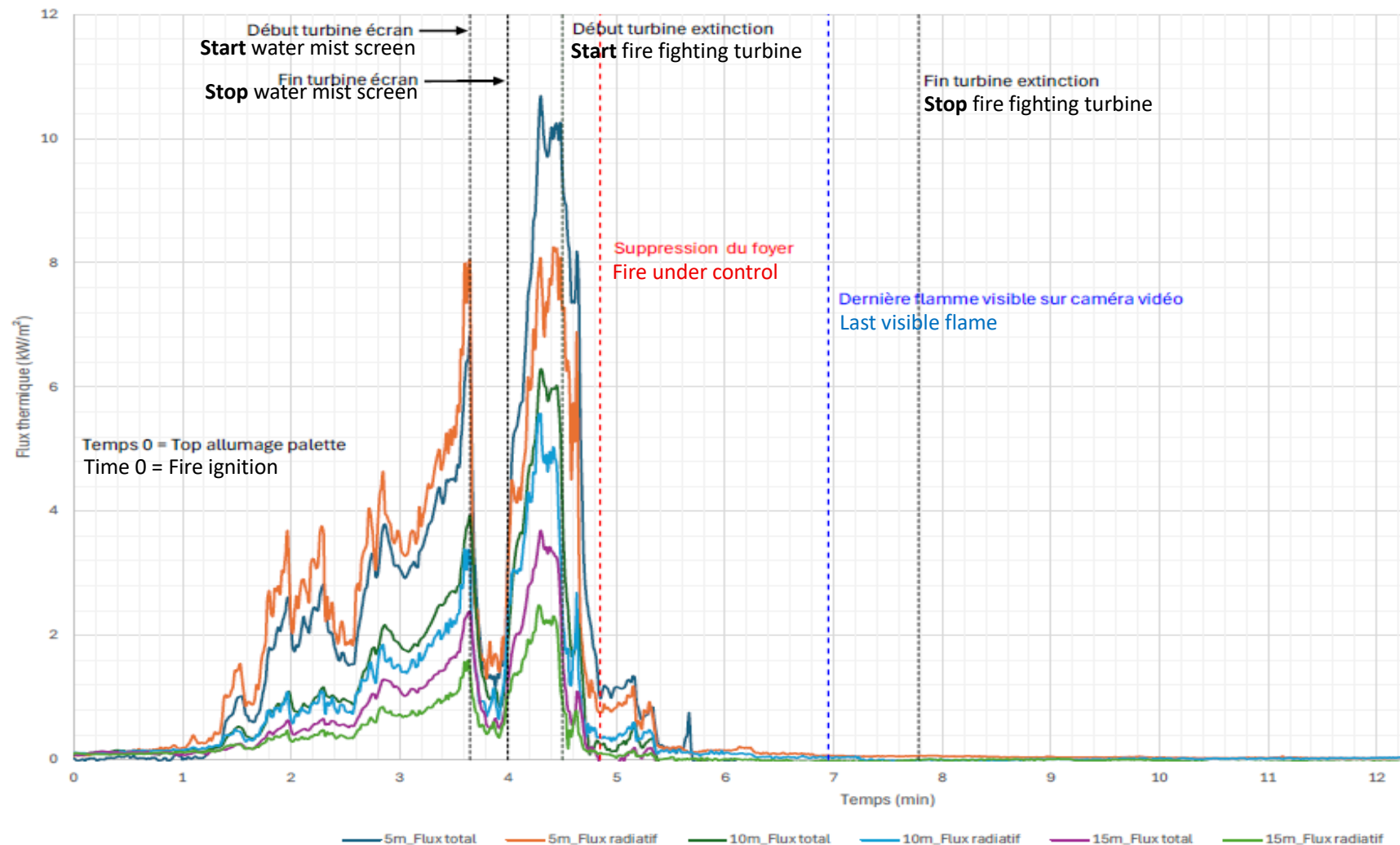
Essai n°	Nombre de palettes	Hauteur foyer	Largeur foyer	Surface foyer en façade	Photos du foyer
1	48	3,1 m	1,6 m	5 m ²	
2	96	2,1 m	4,8 m	10,1 m ²	
3	133 en façade + 16 en arrière-plan	2,2 m	6,4 m	14,1 m ²	

Fire Load
7 776 MJ
15 552 MJ
24 138 MJ
(2 700 MJ/m²)

with hidden fire behind the
main pallet wall



Flux thermiques en fonction du temps (essai 3)



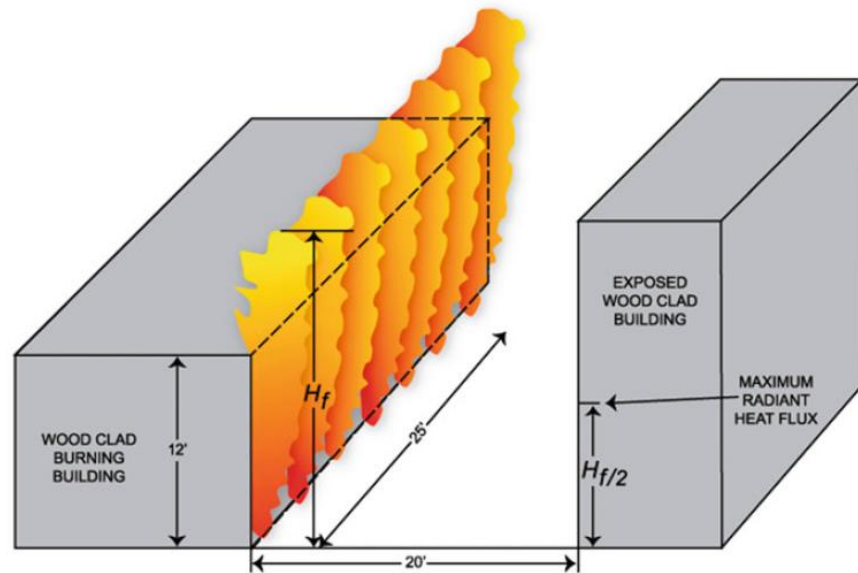
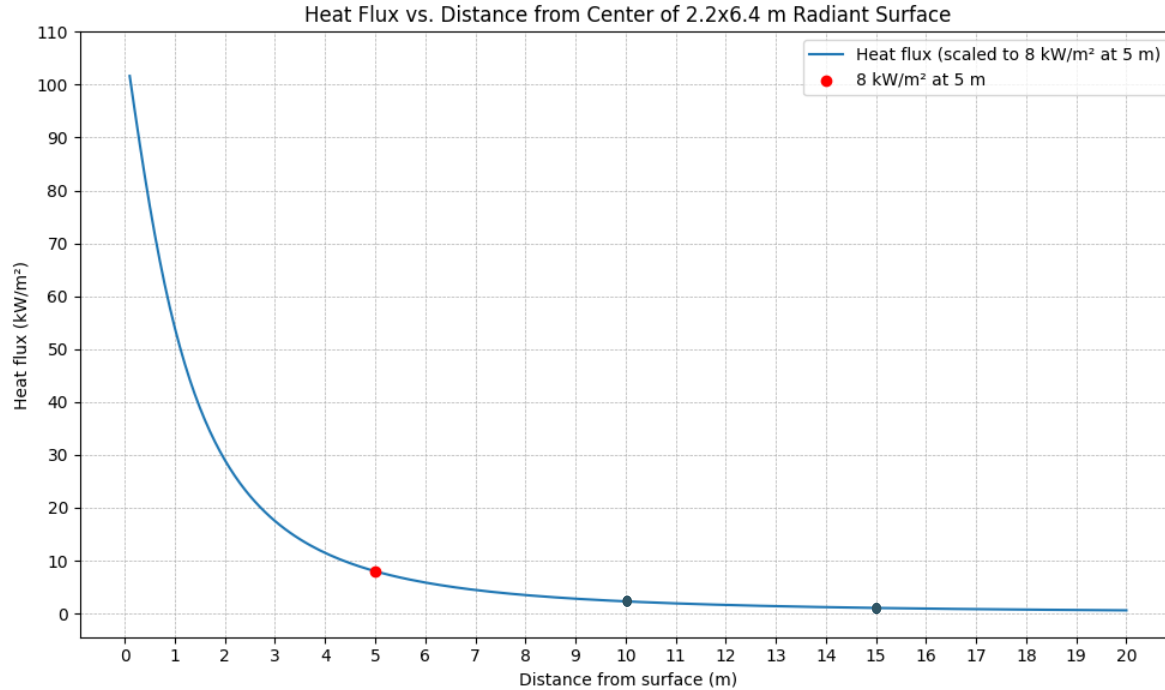


Fig. 86.3 Fire involved building with 17 ft high flame front radiative exposure

Calculation of view factor



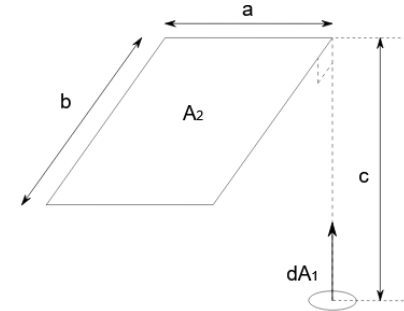
a (a > 0):
 b (b > 0):
 c (c > 0):

Analytical calculation 0.08857437250647503

Monte Carlo method 0.08866

$$F_{d1-2} = \frac{1}{2\pi} \left(\frac{A}{\sqrt{1+A^2}} \arctan \frac{B}{\sqrt{1+A^2}} + \frac{B}{\sqrt{1+B^2}} \arctan \frac{A}{\sqrt{1+B^2}} \right)$$

where $A = \frac{a}{c}$, $B = \frac{b}{c}$



FIRE FACTS

Heat Flux & Response

This fact sheet provides information for a set of heat flux levels commonly experienced during firefighting operations and information on the human response to these heat flux levels. The unit kW/m^2 defines an amount of heat energy or flux that strikes a known surface area of an object. The unit (kW) represents 1000 watts of energy and the unit (m^2) represents a surface measuring one meter long and one meter wide. Example: 1.4 kW/m^2 represents 1.4 multiplied by 1000 and equals 1400 watts of energy on a surface area equal to one meter square.

Heat Flux Level kW/m^2	Response
≈ 1	A typical clear day solar flux on the earth's surface with direct solar radiation; a sun burn may occur in approximately 20 min to 30 min. ¹
2.5	Typical firefighter exposure and working environment ² (About 2.5 times the solar flux).
4.5	Unprotected human skin will receive a second degree burn injury in about 30 s. ³ (About 4.5 times the solar flux)
6.4	Unprotected human skin has pain with 8 s exposure and blisters in 18 s with a second degree burn injury. ³ (About 6.4 times the solar flux)
10	Unprotected human skin will receive a second degree burn injury in about 10 s ³ (About 10 times the solar flux.)
13	Wood volatiles ignite with flame exposure. ⁴ (About 13 times the solar flux)
16	Unprotected human skin experiences sudden pain and blistering after 5 s exposure with second degree burn injury. ³ (About 16 times the solar flux)
20	Unprotected human skin will receive a second degree burn injury in less than 4 s ³ . This heat flux level represents the heat flux in a room at floor level at the beginning of flashover. ⁴ (About 20 times the solar flux)
80	Unprotected human skin will receive an instant second degree burn injury. ³ Flashover is established in a room. ⁴ (About 80 times the solar flux)
84	Heat flux level specified in the NFPA 1971 test for Thermal Protective Performance (TPP) to evaluate firefighters' thermal protective clothing. ³
170	Maximum heat flux level measured by NIST with a post-flashover fire inside a burning room. ⁵ (About 170 times the solar flux)

Heat Flux (kW/m^2)

Effect on structures (source: CNPP)

5	Significant glass breakage
8	Onset of domino effects; severe structural damage
16	Prolonged thermal exposure of structures; corresponds to very severe damage (excluding concrete)
20	Sustained resistance of reinforced concrete for several hours; corresponds to very severe damage in concrete structures
200	Structural failure of reinforced concrete within several tens of minutes

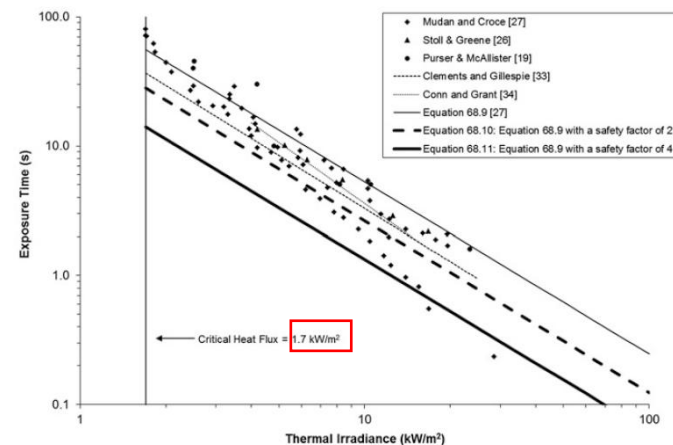
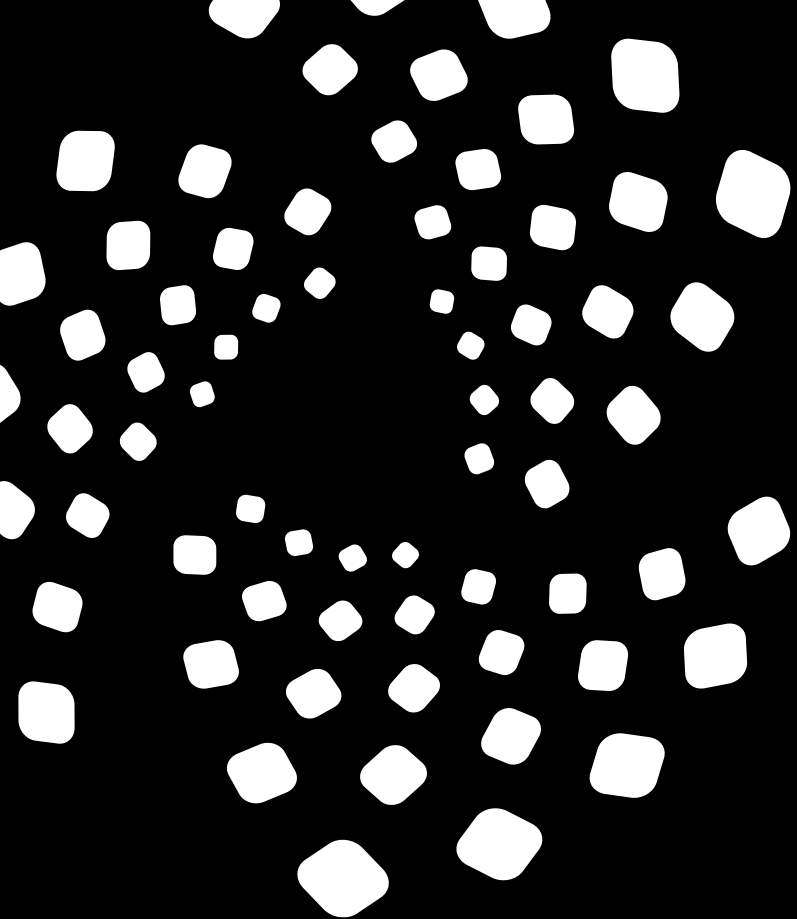


Fig. 68.6 Time for pain on a plot of exposure time versus Thermal irradiance. Individual data are shown as points and curve fits to data are thin lines

Conclusions

Rapid extinguishing: Under the same pressure and flow conditions, the **extinguishing** turbine, regardless of its distance, enabled rapid suppression of the fire between 6 and 44 seconds over a distance of up to 50 metres.

Effective shielding effect: Under the same pressure and flow conditions, the **screen** turbine significantly reduced (up to 78%) the heat flux 5 metres from the source in all three tests.



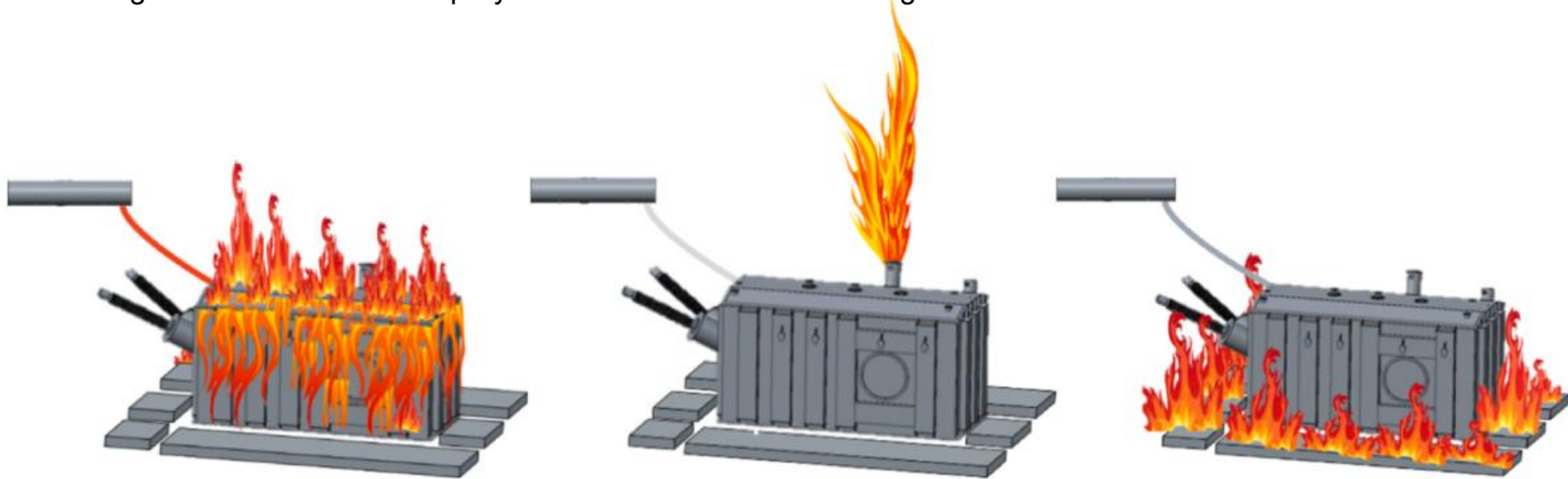
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OIL FIRE – Transformer stations

FSJ PUBLICATION

Report of Transformer accident cases

the insulating oil often overflows or sprays out from the cracked bushings



(a) Flowing fire

(b) Spray fire

(c) Pool fire

Test design

Flowing fire + spray fire + pool fire – HRR(tot): 116 MW

Oil overflow rate was set at 150 l/min.

Nozzle orifice diameter 1.6 mm, K-factor 3.1, flow rate 0.15 kg/s

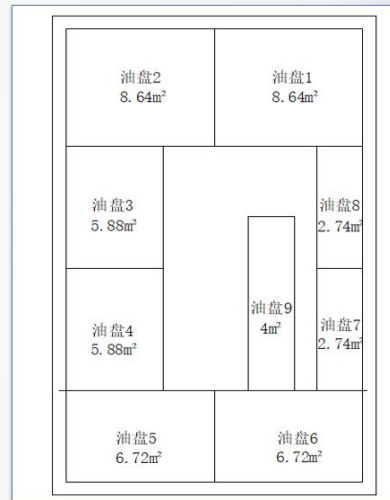
- One of the nozzles horizontally pointed to the side firewall
- The other one vertically pointed to the sky.

Oil layer in pans 10 cm

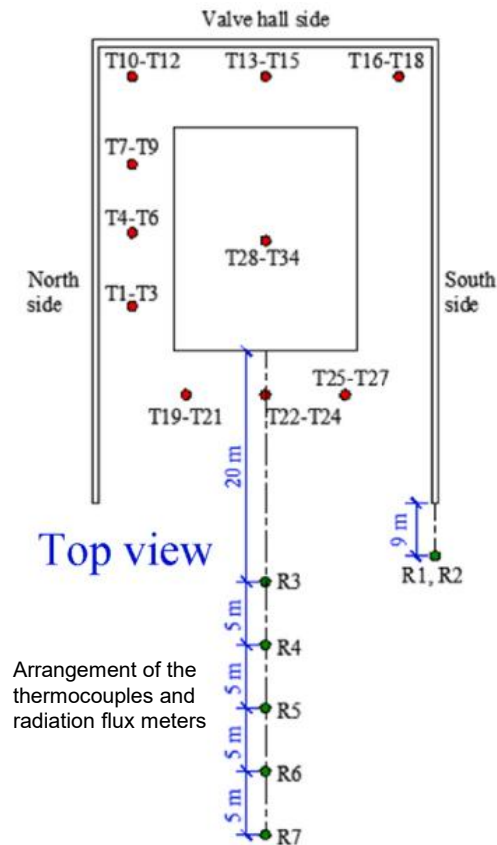


Fire Model

【Oil sump fire setting on top of oil sump pit and the body】



国家电网
STATE GRID



<https://www.youtube.com/watch?v=O2-IXWi7IZk>





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Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Fire Safety Journal

journal homepage: www.elsevier.com/locate/firesaf

Extinguishment of a transformer fire with a long projection water mist system

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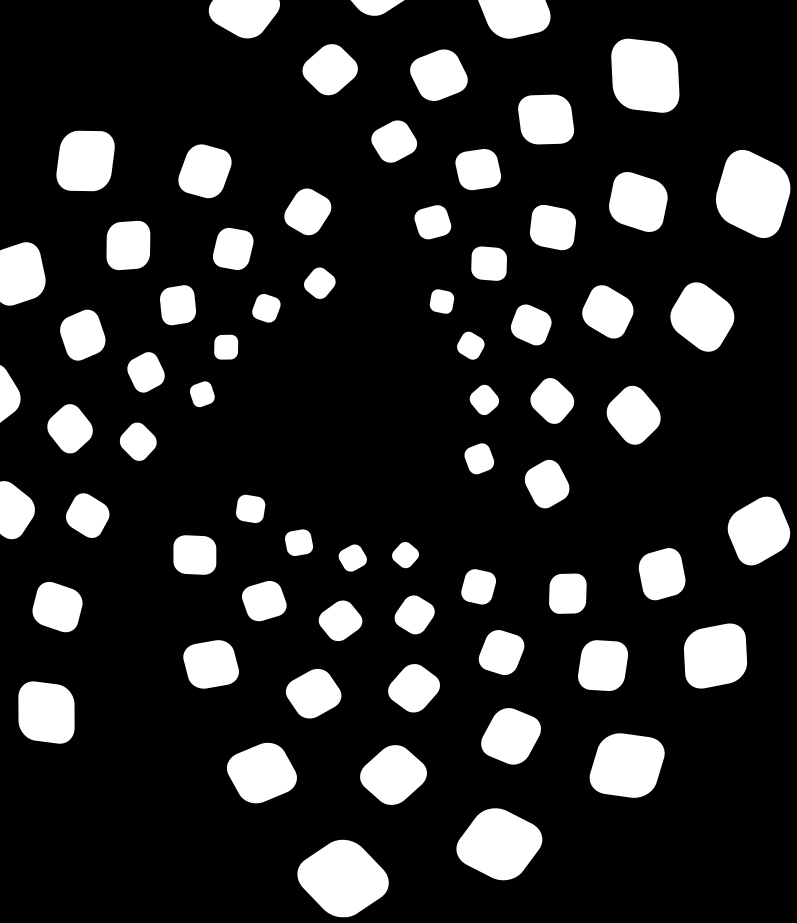
ARTICLE INFO

Keywords:

Water mist
Spray characterization
Fire extinguishment
Axial flow induced spray
Transformer fire

ABSTRACT

When large oil-immersed power transformer fire happens, scenarios such as bushing explosion, oil pool fire, oil spray fire and oil flowing fire are commonly observed. As the nozzles of current water mist or sprinkler system are arranged in the fire region, they are at risk of damage during the explosion or under high temperature. This paper presents a long projection water mist technique based on axial flow inducing to effectively extinguish the fire at far distance. The droplet size, spray density, and effective spray distance were characterized via Laser diffraction technique, water collection method and laser distance measurement. Fire extinguishment tests were conducted through setting up a full-scale 800 kV converter transformer model to verify its capability. The results indicate that the proposed system can extinguish the 800 kV converter transformer fire within dozens of seconds, due to its long spray distance, small droplet size, and large spray density. This study will provide a new method for water mist generation and references for system design for large transformer fire or oil fire extinguishment in open space.



Conclusions

Conclusions

	Colours						
Types		Fires involving wood, paper, textiles etc.	Fires involving flammable liquids, petrols, spirits etc.	Fires involving flammable gases, butane, propane etc.	Fires involving burning metals, e.g. magnesium	Fires involving electrical equipment	Fires involving cooking oils and fats

1. **Water mist** remains the decisive success factor, while **turbine** assistance removes the limitations of short throw distance and lack of momentum. For **large-scale industrial fires**, this combination appears promising both for extinguishment and for heat shielding.
2. In the current **transition away from fluorinated foams**, turbine-based water mist deserves serious consideration as a lower-water, foam-compatible and increasingly standardized alternative for selected hazards.
3. From an engineering perspective, future work should **emphasize independently published test matrices**, scenario-specific acceptance criteria, and alignment with certification pathways and relevant watermist standards such as EN, NFPA and VdS.

SMALL DROPLETS, BIG IMPACT

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