

# The state of the art of water mist technology

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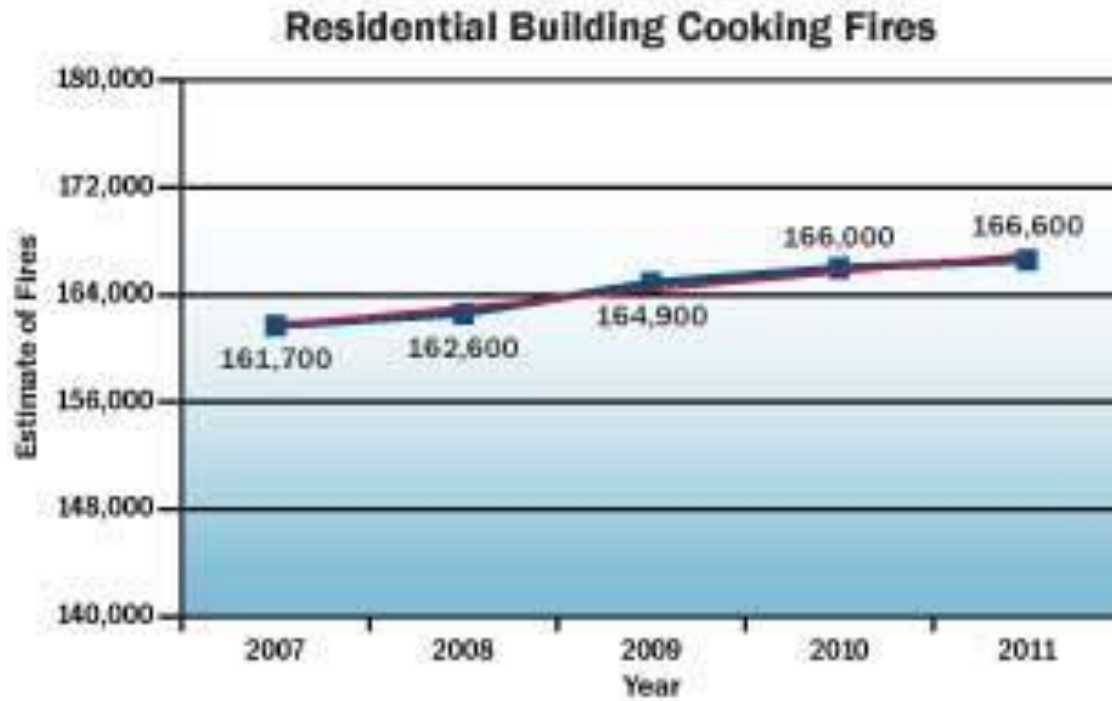
## Topics covered in this presentation:

- Fire statistics
- Acceptance of water mist
- New applications
- Standardisation
- Development
- IWMA's role

## Fire statistics:

- **Economy Watch:** In USA:
- Fire contributes to the maximum number of deaths occurring in America due to natural disasters.
- Eight out of ten fire deaths take place at home.
- A residential fire takes place after every 77 seconds.
- The major reason for a residential fire is unattended cooking.
  
- Trend: To see fire as vulnerability for the society (Wildland fires, earthquake, tsunami, storms, terrorism)

USA:



# Fire statistics

- 1% of Gross Domestic Product in developed countries in direct loss due to fire
- 2.5% of GDP in USA, taking into account direct and indirect costs, such as:
  - Direct fire losses
  - Indirect fire losses
  - Insurance coverage
  - Fire departments and volunteer fire fighters
  - Fire protection of buildings and constructions
- This means that investment in watermist systems can make a big difference

# Acceptance of water mist

- *Jack Mawhinney writes:*
- *The basic model of NFPA 750 is supportive of **performance-based design and allows innovation** in the design of water-based fire protection systems. However, some potential end-users and manufacturers believe that the document is not an "installation standard" in the same mold as NFPA 13. NFPA 13 contains sufficient information to provide instruction on design criteria and detailed installation instructions for the hardware, that is, the pumps, pipe, fittings and hangers.*
- *The designer may reference additional data sheets associated with special listed items, for example, special application sprinklers, but the majority of the technology associated with conventional sprinklers is contained in the standard itself or its appendices. The NFPA 750 approach is similar in principle, except that, because the content of technology utilized by different water mist equipment manufacturers may be new to the fire protection world, **reliance on the external listing data sheet and DIOM manual is greater than with NFPA 13.** Information that is necessary to accomplish a design and install the hardware is found only in the manufacturer's proprietary **DIOM manual.***
- When it comes to Europe, this is also a valid comment. The end users of water mist systems are not used to the DIOM (Design, Installation, Operation and Maintenance ) manuals.

## More from Jack Mawhinney:

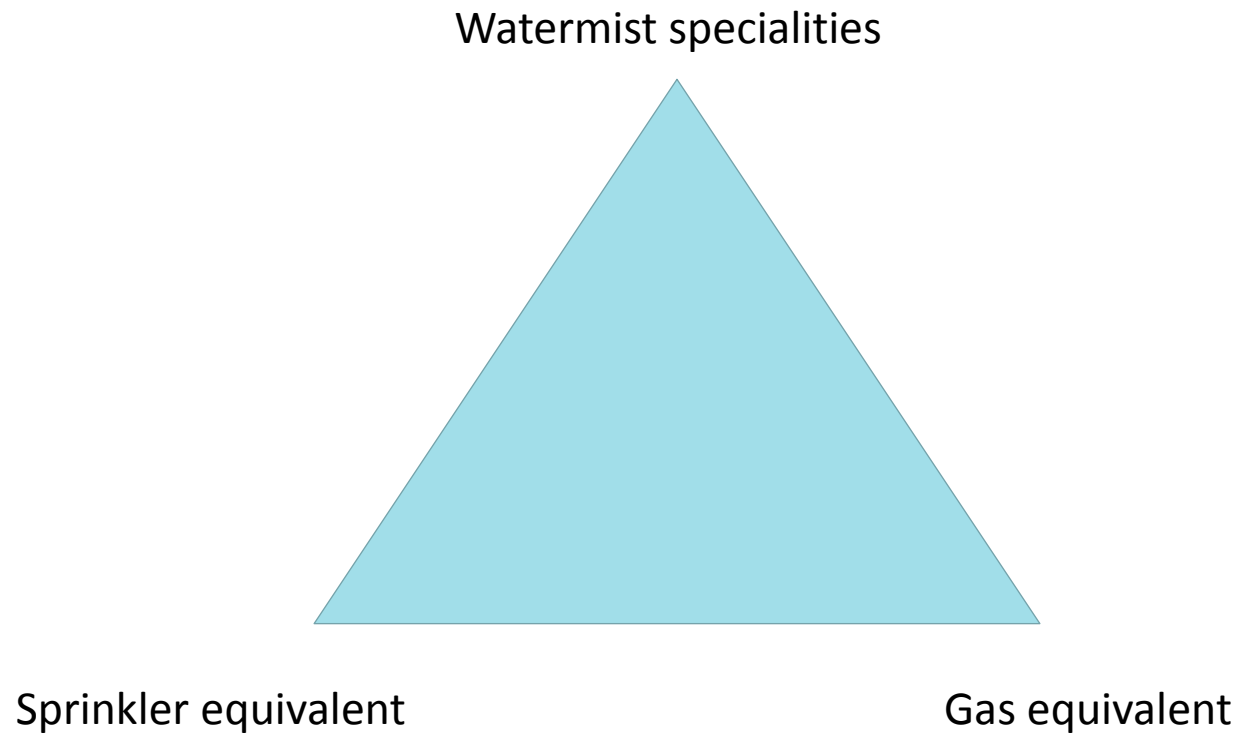
- *Whatever change proposals are made, it is important not to lose sight of the original philosophy of **allowing innovative technologies to be used to improve the efficiency of fire suppression systems.***
- *A second barrier to the acceptance of water mist systems in land-based applications is that there are **not enough approvals for the range of fire hazards encountered in buildings.** Water mist sprinkler systems are already installed in accommodation spaces, shopping areas and public areas throughout passenger ships, and are approved under IMO as fully equivalent to sprinkler systems. However, there is limited comparable recognition for water mist sprinkler systems in land-based buildings.*
- *It is in the interest of proponents of water mist systems to prevent harm being done to the credibility of the technology by spread of misinformation and inappropriate performance claims of water mist. Reported **successes** and demonstrated capabilities provide a foundation upon which confidence in water mist systems will rest. Successful control of fires by water mist should be documented for all types of water mist systems, including land-based systems and marine systems similar to automatic sprinkler systems. **Failures** in badly designed fire protection will potentially occur, as they do with all fire protection systems. Accurate reporting of such incidents is needed*
- *The next edition of NFPA 750 (2013) will hopefully strengthen the message that water mist systems require quality maintenance to remain reliable over time. **Inspection, testing and maintenance procedures** must be frequent, thorough and sustained over the service life of the system. The true cost of maintenance should be factored into the life-cycle cost of the systems.*

# Acceptance

- Even though there is a general scepticism against the "new" technology, there is a common acceptance that watermist fire protection systems have demonstrated their value in assisting the protection of life and property in industrial and commercial applications for many years.
- A correctly designed, installed and properly maintained watermist fire suppression system can detect, suppress and control a fire at an early stage of development, and activate an alarm. Operation of the system will rapidly reduce the rate of production of heat and smoke, allowing more time for the occupants to escape to safety or be rescued.
- The fire suppression leads to substantial reductions of material damage, and will normally constrict the fire damage to the near vicinity of the outbreak area.
- The basic concept of acceptance of watermist systems is that the performance is documented by relevant fire tests
- A bi-product of watermist tests is that other active fire protection systems (sprinkler) performance has been documented (equivalency testing)



## Some types of watermist applications:



# Applications:

- Much of the work with standards has been concentrated on equivalent systems, like the sprinkler equivalent systems and the replacement of Halon systems
- Some applications based on successful testing are:
  - Turbine enclosure protection
  - Protection of heritage buildings, museums, libraries and collections
  - Road and rail tunnels
  - Aircraft and hangar protection
  - Industrial fryers (deep fat fryers)
  - Cable tunnels
  - Local liquid fire sources

# Standardization

- We have obtained a good basis for standardizing watermist systems and its use internationally for the marine sector.
- Standardization for the land-based sector in Europe has not reached this stage, and the national standardization bodies still are developing special standards for the design, installation and maintenance of watermist systems.
- In US the national standards have developed quite extensively. Both the NFPA, UL and FM have developed standards for certain applications.
- In Oceania, New Zealand has developed their own standard, as well as Australia.
- In Asia, US standards are mostly used, but some attempts to make national standards can not be disregarded.

## Possible new applications:

- Flashover protection in large spaces (fire control, fire suppression rather than complete extinguishment of fires)
- Zoned protection of large spaces (marine, larger machinery spaces, also to general applications)
- These applications lacks specific standards for approval and acceptance.



## Example of use of analytical design: Example from Nordic countries:

### **4.3.2.2 The impact of an automatic fire suppression system**

If there is an automatic extinguishing system, the fire load in the relevant fire compartment can be reduced.

#### **General recommendations:**

**Consideration can be given to the impact of an automatic fire suppression system according to BBR 5:252 by the design fire load being reduced to 60% of its original value.**

# Example of use of analytical design:

## 3.4.5 The impact of an automatic fire suppression system

### General recommendations:

The effect of an automatic fire suppression system can be considered as indicated below. For other types of extinguishing systems not listed below, a specific assessment should be carried out.

If the heat release development upon activation of an automatic water sprinkler system or residential sprinklers is no more than 5.0 MW, heat release can be reduced as follows:

- After the sprinkler activation, heat release is kept constant for 1 minute.
- Then the heat release reduces to 1/3 of the release at the time of activation. This reduction occurs during the ensuing minute.
- Heat release is then kept constant at this level.

If the fire's heat release at sprinkler activation is greater than 5.0 MW, the heat release should be assumed to be constant after sprinkler activation.

## Suggested Swedish recommendation for analytical design of fire protection for buildings

**Table 7 Level of critical impact in the analysis of evacuation safety**

<b>Criterion</b>	<b>Level</b>
<b>1. Smoke layer level above floor</b>	<b>Lowest <math>1.6+0.1 \times \text{room height}</math></b>
<b>2. Visibility, 2.0 m above floor</b>	<b>10.0 m in areas <math>&gt; 100 \text{ m}^2</math> 5.0 m in areas <math>\leq 100 \text{ m}^2</math> The criterion can also be applied to situations where queue formation occurs at an early stage at the location where the queue develops.</b>
<b>3. Heat dose</b>	<b>max. <math>60 \text{ kJ/m}^2</math> above energy from a radiation level of <math>1 \text{ kW/m}^2</math></b>
<b>4. Temperature</b>	<b>max. <math>80^\circ\text{C}</math></b>
<b>5. Heat radiation</b>	<b>max. <math>2.5 \text{ kW/m}^2</math> or</b>
<b>6. Toxicity, 2.0 m above floor</b>	<b>Carbon monoxide concentration (CO) <math>&lt; 2000</math> ppm Carbon dioxide concentration (CO<sub>2</sub>) <math>&lt; 5 \%</math> Oxygen concentration (O<sub>2</sub>) <math>&gt; 15 \%</math></b>

# Residential sprinkler standards and equivalent watermist systems

- Important application, both due to the frequency of residential fires and the life threat of these fires
- Nordic initiative: Fixed firefighting systems has to be installed in all new buildings with a certain number of occupants and escape possibilities (in practice: Where an elevator must be installed, fixed firefighting systems also shall be installed)
- A suggested addition to INSTA 900 is recently released:
- **Residential sprinkler systems – Part 3: Watermist systems equivalent to residential sprinklers**
- Requirements and test methods for alternative water based fire fighting systems equivalent to residential sprinkler systems as required in INSTA 900-1 and 2



# TYPICAL FIRE SOURCE IN RESIDENTENTIAL SPRINKLER TESTS (Simulated furniture)



# Development

- Watermist was launched as alternatives to existing firefighting systems in marine applications, IMO FTP Code:
  - Revised guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 (resolution A.800(19))
  - Alternative arrangements for halon fire-extinguishing systems in machinery spaces and pump-rooms (MSC/Circ.668, as amended by MSC/Circ.728)
- Watermist is introduced by several insurance-based approval bodies (VdS, UL, FM)



## Focus in standardization work:

- I think that another possible solution to succeed in the land-based market would be to work with a standard for deluge systems, not the sprinkler-equivalent nozzles released one by one.
- Systems covering zones of a space, released by smoke/flame or gas detection are at present treated by the standard for Water Spraying Systems (NFPA 15), using massive amounts of water (5-10, even 20 litres/m<sup>2</sup> min).
- It is important to keep the focus on the approval systems and the acceptance of approved water mist systems as fulfillment of Building Regulations

BRANZ (Building Research Association of New Zealand) has collected reference tests with water-based fire suppression systems:

- Accommodation
- Kitchen/cooking
- Office
- Heritage and Libraries
- Electronic equipment
- Entertainment
- Factory/ Machinery
- Generic compartment





## IWMA's role

- Be the voice of the watermist industry in a much more coordinated way than today
- Provide basic information to the community on water mist technology
- Launch and coordinate scientifically based test protocols where it is lacking
- By conferences and seminars world-wide spread the knowledge about watermist technology to the advisers and end users

## Conclusions:

- Common acceptance of watermist systems is achieved in many parts of the world
- Due to the differences between systems, no prescriptive standards have been written.
- Still there is a lack of knowledge of how systems can be documented and accepted by Authorities Having Jurisdiction
- IWMA has been instrumental in the work to revise the present CEN TS 14972
- IWMA has restructured its organization, moved office to Hamburg and will be more visible and professional
- Many of the large international manufacturers of firefighting equipment have developed watermist systems or acquired existing watermist producers
- In the future, IWMA should be the leading voice to open for acceptance of watermist systems in applications where its peculiarity is important, as a fully accepted alternative to other accepted firefighting systems