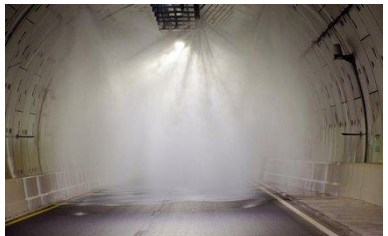
WATER MIST FOR SPRINKLER DESIGNERS

Modern Water Mist Technology
Opportunities and Limitations

Max Lakkonen

President, International Water Mist Association (IWMA) | Managing Director, IFAB Finland Oy




Content of my presentation

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Introduction

Who is talking, and what IWMA does

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Opportunities and limitations

THE MESSAGE IN ONE SENTENCE

Water mist is mature, tested and standardised, and a sprinkler designer already has most of the skills needed to design it. Water mist industry is rapidly increasing.

Introduction

Part 1

Who is talking, and what is the International Water Mist Association IWMA

About me: Max Lakkonen



Connect:
Max Lakkonen

20+
years in fire safety engineering

100+
publications

10+
patents

Background

- M.Sc. in Mechanical Engineering and Lic.Tech. in fluid power and automation (Tampere University of Technology)
- 8 years in Finnish academia.

IFAB – Institute for Applied Fire Safety Research (Director)

- Fire safety research, consultancy and engineering in Germany and Finland.
- Accredited fire test laboratory: hundreds of fire and smoke tests, CFD, design.

Standards and associations

- President of IWMA.
- NFPA 750, 502 and 130 technical committees.
- CEN/TC 191 WG10 / WG6 (EN 14972).
- ITA-COSUF steering board.

Projects

- Many International projects e.g. Channel Tunnel, high-speed rail, Hyperloop, road tunnels, data centres and battery storage.
- Lecturer and author in fire protection media.

IWMA at a glance

Promotes good practice and the safe use of water mist technology worldwide

1998
founded

Hamburg
headquarters, Germany

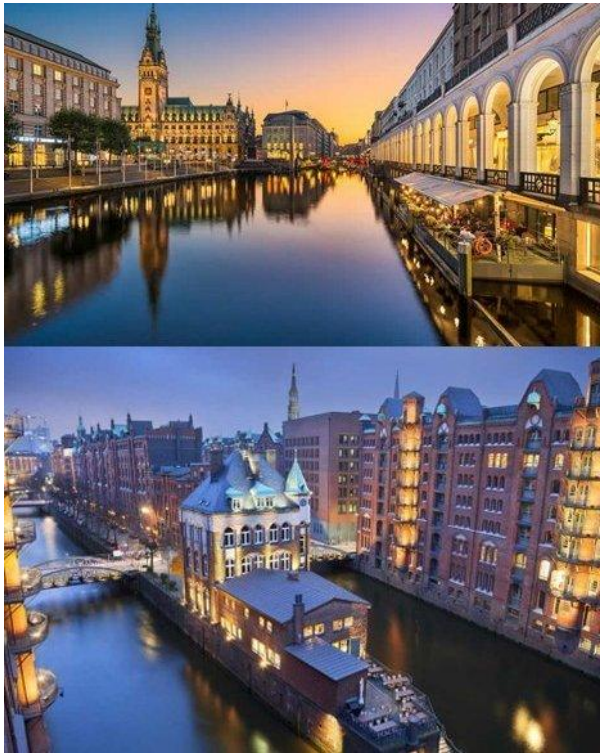
+40%
corporate members, 2025 and 2026

OUR MEMBERS

- Experts and designers
- Manufacturers
- Installers
- Users and owners
- Insurers
- Associations

WHY WE EXIST

Promoting water-based fire fighting and good practices, with a special focus on water mist: a very effective use of water, suitable for many applications.



What IWMA does for designers - Examples

Water Mist Guide

Key facts on water mist: definitions, objectives, classification, applications, DIOM manuals, approvals, maintenance.

Water Mist Design Guide

New in 2026: a step-by-step design route following EN 14972, with checklists and a sprinkler comparison.

IWMA Matrix

Index of land-based and marine fire test protocols: which standard and protocol applies where.

Competence Scheme

In preparation: independent certification of water mist companies, based on ISO/IEC 17065.

Standards work

Active, directly or through members, in standards groups in Europe and North America.

Mist Protects

New evidence initiative: real fires, reference installations and research in one place.

IWMC 2026, PRAGUE

25th International Water Mist Conference: about 190 participants from 32 countries, a record. Guides, Matrix and conference papers: iwma.net

Evolution of water mist

Part 2

From early trials and a ship fire in 1990 to a mature, growing global industry

A short history of water mist

Early 1900s
First trials with fine water sprays. For decades, only random applications.

1990
Scandinavian Star fire. Swedish and Finnish pioneers start serious development.

1996
First edition of NFPA 750, the US water mist standard.

2020
EN 14972-1 published, with application fire test protocols in the series.



1987
Montreal Protocol: the Halon phase-out starts the search for clean alternatives.

1995
IMO Resolution A.800: fire-test route for sprinkler-equivalent systems on ships.

1998
IWMA founded in Hamburg.

2026
IWMA Water Mist Guide and Design Guide for designers.

NORDIC ROOTS A few believers in Sweden, then rapid commercialisation driven mainly from Finland, followed by Denmark and Norway

1990: the fire that changed the rules



Scandinavian Star, 1990


Icon of the Seas, 365 m

- **7 April 1990:** arson fire on the passenger ferry Scandinavian Star. 159 people lost their lives.
- **IMO response:** sprinklers on passenger ships and, from 1995 (Resolution A.800), equivalent systems approved by full-scale fire tests.
- **Water mist passed and won the market:** less water and weight on board, and a Halon replacement for machinery spaces.

159
lives lost

1995
IMO Resolution A.800

≈100%
of large passenger ships today

THE SAME ROUTE ON LAND

Equivalence proven by full-scale fire tests is exactly how land-based water mist is approved today.

From ships to buildings and industry

Marine

Cruise ships, ferries and machinery spaces: the proving ground.

Industry and energy

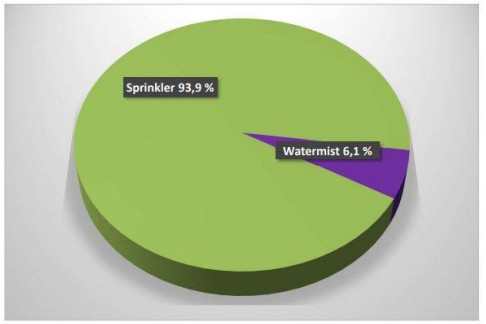
Turbines, generators, machinery, fryers: replacing gas and foam. Data centers!!!

Infrastructure

Road and rail tunnels, rolling stock and buses.

Buildings

Hotels, hospitals, offices, high-rise, heritage and homes.



Norway 2024: share of water-based systems (source: BTF)

COUNT VALUE, NOT NOZZLES

Nozzle counts understate water mist: price per nozzle and protected area differ from a sprinkler head. The market value of water mist systems has grown significantly.

The water mist industry is growing

- Manufacturers report good or record financial years for 2025
- Some countries flat, but internationally water mist keeps gaining ground
- Investors are interested: acquisitions and investments in the industry
- IWMA grows with it: +40% corporate members in 2025 and 2026



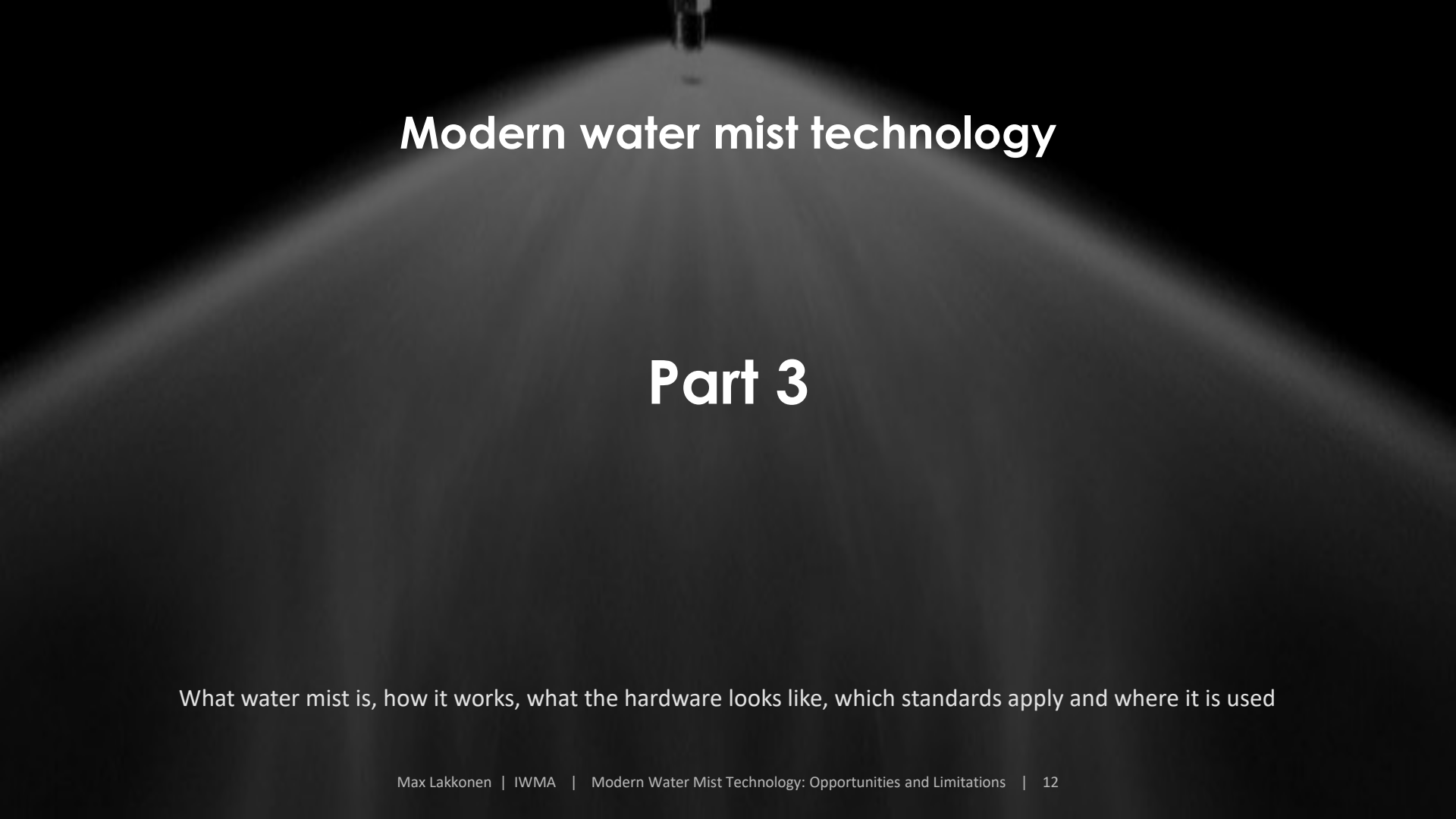
≈ €1.5+ bn estimated end-client market value of water mist systems

Efficiency
less water

Eco-friendly
no additives

Standards
in place

Fast
on new hazards



Modern water mist technology

Part 3

What water mist is, how it works, what the hardware looks like, which standards apply and where it is used

What is water mist?

Water mist: Volumetric droplet distribution is below 1000 µm (1 mm) diameter across the nozzle operating pressure range.



Low pressure

Up to 16 bar (European practice).
Larger mist or less momentum droplets.

High pressure

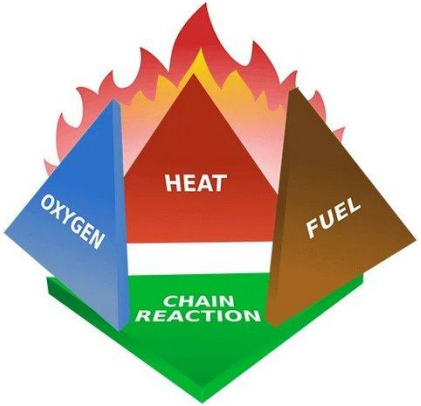
Above 16 bar, usually up to 200 bar.
Smaller mist or/and higher momentum droplets.

REMEMBER Pressure class alone never establishes suitability: every system is fire tested and approved for its application.

How water mist fights fire

1700 ×

2257 kJ



Cooling

Each litre that evaporates absorbs about 2257 kJ. Small droplets evaporate fast in the flame and hot gases.

Oxygen displacement

Water vapor expands about 1700 times and displaces oxygen locally at the fire, not in the whole room.

Radiant heat blocking

The mist cloud blocks radiation, protecting people, structures and neighboring fuel.

Wetting

Secondary: wets surfaces and prevents re-ignition, depending on the application.

WHY SMALL DROPLETS MATTER

Heating one litre from 20 °C to 100 °C takes 335 kJ; turning it into steam takes 2257 kJ. Small droplets put that capacity to work where the fire is.

Less water, more versatility

Instead of sprinklers or deluge

Significantly less water: smaller tanks, pumps and pipes, and far less water damage.

Instead of foam

Many flammable liquid fires extinguished without additives: nothing to collect or dispose of.

Instead of gas

No airtight enclosure and no toxic agent; discharge continues as long as the water lasts.

A	Solids	✓	B	Liquids	✓	C	Gases (isolate)	✓	F	Cooking oils	✓
	Electrical	✓	D	Metals	✗						



Class F: deep fat fryers



Class B: pool fires

7 vs 24 kg CO_2e/m^2

Hospital study, Norway
Multiconsult 2022, Sykehuset Østfold Kalnes

Familiar hardware, different scale



Pump units



Valves



Pipes and fittings



Nozzles

	Low pressure	High pressure
Pressure	Up to 16 bar	Above 16 bar, usually up to 200 bar
Droplets	Larger	Smaller
Pipework	Stainless steel or approved plastic (CPVC, PP, PEX-A)	Stainless steel pipe, hoses and fittings
Water supply	Low pressure pump set	High pressure pump unit or gas cylinders

THE KEY DIFFERENCE

The system is approved as a whole, so components are those covered by the approval and the DIOM manual. Typically smaller pipes and tanks; more electric power for high pressure.

A mature framework of standards



EN 14972 series

Part 1 (2020): design, installation, inspection, maintenance. Further parts: application fire test protocols.

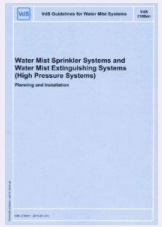


NFPA 750

Standard on Water Mist Fire Protection Systems, first edition 1996.

FM Approvals

FM 5560 approval standard and FM Data Sheet 4-2 for insured property.



VdS

VdS 3188 guidelines with certified systems and components.

Components: EN 17450 series

Marine: IMO

Rail and bus protocols

IWMA MATRIX index of land-based and marine fire test protocols, kept up to date as parts are published (iwma.net)

References: complex buildings



Makkah Royal Clock Tower



Hospitals



Munich Olympic tower, 291 m







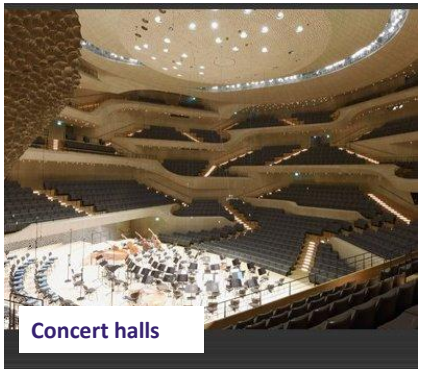
Offices and public buildings



Hotels

References: heritage and culture


Elbphilharmonie, Hamburg


Concert halls


Notre-Dame, Paris


Palacio de Cibeles


Libraries and archives

Why heritage chooses mist: little water damage, small pipes that are easy to hide, fast cooling under historic roofs.

References: infrastructure and industry



Special tunnels


Road tunnels


Marine


Rail and buses


Data centres


Battery energy storage


Power and transformers

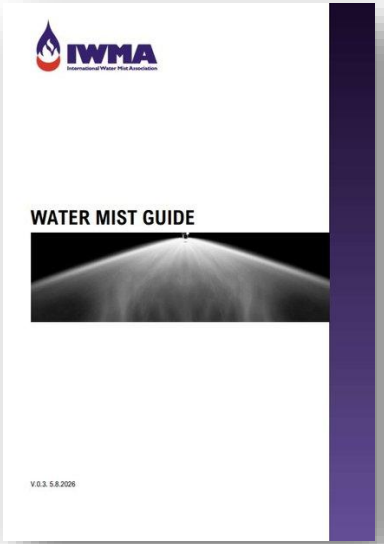

Industry and fryers

Designing water mist: the IWMA guides

Part 4

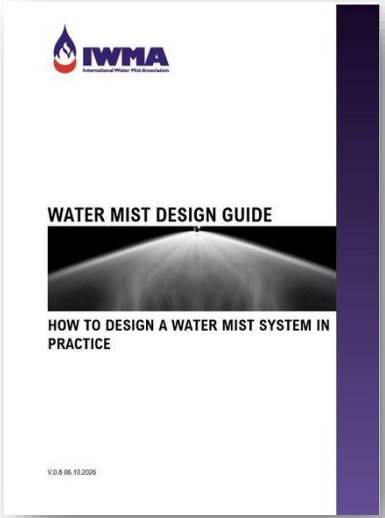
The IWMA Water Mist Guide and Design Guide, step by step, compared with what you already do for sprinklers

Two IWMA documents for designers



IWMA Water Mist Guide (2025)

- Key facts on water mist as a fire fighting technology
- Definitions, objectives, classification, applications
- DIOM manual, approvals and maintenance
- Explains the standards and their limits; does not replicate them



IWMA Water Mist Design Guide (2026)

- Companion document, new in 2026, no requirements of its own
- Step by step: objective, protocol, evidence, design, commissioning, handover, maintenance
- Checklists and templates for project use
- Follows the EN 14972 route; FM and VdS routes mentioned

WRITTEN WITH SPRINKLER DESIGNERS IN MIND

The Design Guide follows a workflow of sprinkler systems. The key difference is where the numbers come from: DIOM manual vs. a presprective table in the standard.

Where the design values come from

Fire test protocol → Fire test report / summary → **DIOM manual** → Project design and calculation → Commissioning and certificate

Sprinkler design

Design density and area of operation come from the installation standard (e.g. EN 12845) for the hazard class. Generic: valid for any listed sprinkler.

Water mist design

Flow, pressure, spacing, height, area of operation and duration come from a full-scale fire test of that specific product, recorded in its DIOM manual. Other steps are same than for sprinklers.

THINK OF IT THIS WAY

The DIOM manual is your design table, written for one product and proven by fire test.

EN 14972-1 gives the method, not the water quantities.

Most systems are type approved: protocol, test summary and DIOM manual are covered by one third-party checked document set.

The Design Guide: (19 steps) and 7 gates

PART I · DEFINE	PART II · ROUTE	PART III · EVIDENCE	PART IV · DESIGN	PART V · PROVE
1 Objective	5 Governing standard	8 DIOM manual	11 Design basis and architecture	15 Documentation
2 Stakeholders	6 Fire test protocol	9 Fire test summary / type approval	12 Nozzle layout and hydraulics	16 Review and sign-off
3 Hazard	7 Equivalency route	10 Components and certification	13 Water supply	17 Installation inspection
4 Constraints			14 Controls, interfaces, safety	18 Commissioning, handover
				19 Through-life management

GATE 1	GATE 2	GATE 3	GATE 4	GATES 5 TO 7
Project basis accepted	Compliance route accepted	Evidence accepted	Design frozen	Approved, handed over

FAMILIAR	WATER MIST: ROUTE AND EVIDENCE	FAMILIAR FROM SPRINKLER PROJECTS

Habits to change from sprinkler design

INSTEAD OF		DO THIS
Laying out first and choosing the product afterwards	→	Choose the tested system first: spacing, pressure and design area are product-specific
Reading values across between manufacturers	→	Treat each system on its own: the same pressure class can mean entirely different values
Looking for the answer in the standard	→	The standard gives the method; the DIOM manual gives the answer
"Equivalent to sprinklers" as the only objective	→	State the objective: control, suppression, extinguishment or temperature control

DESIGN CAUTION

Equivalency with sprinklers is a test result, not a design method. Sprinkler rules cannot be applied to water mist, or the reverse.

Mist-conceptions, opportunities and limitations

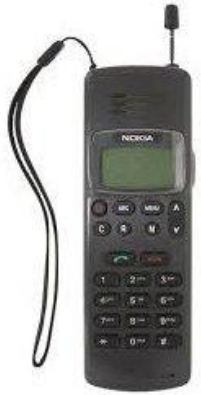
Part 5

Common myths, an honest look at the limits, and what it means for your next project

Mist-conception: new technology?



Sprinkler
100+ years



Water mist
≈ 35 years



Both
next generation

≈ 35 years
of commercial use

30 years
of NFPA 750 (since 1996)

≈ 100%
of large cruiseliners

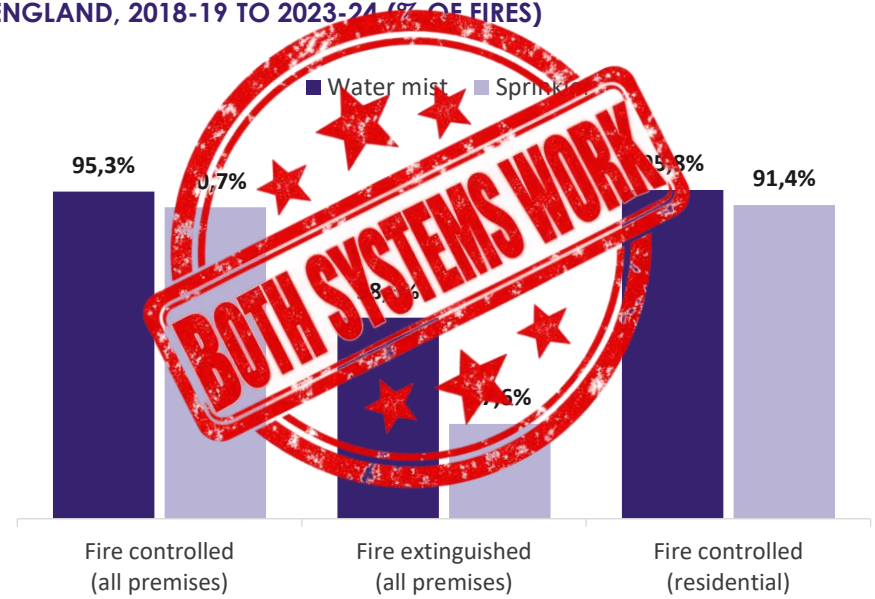
€1.5+ bn
end-client market, growing

DEPENDS ON THE PERSPECTIVE

Both technologies are proven, and both must keep developing for new challenges: the real challenge for the whole fire protection industry.

Mist-conception: not reliable?

ENGLAND, 2018-19 TO 2023-24 (% OF FIRES)



Source: MHCLG, Primary fires in premises with sprinklers or water mist safety systems, 2018-19 to 2023-24 (gov.uk); IWMA analysis, May 2025. Over 4,000 incidents.

Trusted where failure is not an option

Nuclear power plants, cruise ships with thousands on board and major infrastructure rely solely on water mist.

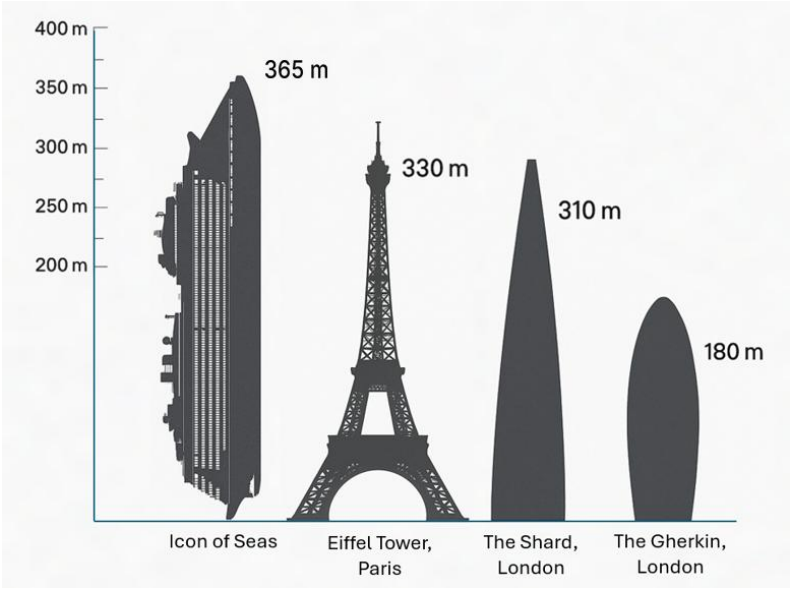
The insurer's view: VdS 3188

"The water mist sprinkler systems described here are to be regarded as equivalent to sprinkler systems in accordance with VdS CEA 4001 in terms of reliability and effectiveness for the respective field of application."

KEY FACTOR FOR BOTH proper inspection and maintenance.

Mist-conception: not reliable?





Mist-conception: complicated or costly?

Complicated?

- ✓ A different approach, not a harder one: system-level approval instead of prescriptive tables.
- ✓ Key inputs: hazard and protocol, the DIOM manual (nozzle, spacing, hydraulics, valves, pump unit), installation and commissioning.
- ✓ The IWMA Design Guide gives you the route step by step.
- ✓ Performance-based design is where fire engineering as a whole is heading.

Verdict: **Different, not difficult**

Expensive?

- ✓ Investment cost for conventional hazards is often higher, except in special cases.
- ✓ Smaller tanks, pipes and plant rooms; far less water damage after a discharge.
- ✓ The first activation alone can offset the cost difference.
- ✓ If it cost too much, it would not sell, yet the market keeps growing.

Verdict: **Compare life-cycle cost, not unit price**

Opportunities and limitations

Opportunities

- **Sustainability:** less water, no additives, lower embodied carbon.
- **Special hazards:** water-sensitive areas; replaces gas and foam systems.
- **Standards momentum:** EN 14972 series, FM, VdS and NFPA 750 keep expanding.
- **Innovation:** fire-test driven solutions for new hazards and complex buildings.

Limitations

- **Awareness:** authorities and engineers may lack training; the concept differs from prescriptive design.
- **Tested parameters:** applications need a matching protocol and approval; outside it, equivalency and often fire testing.
- **Cost:** some strongly cost-driven applications are not (yet) competitive.
- **Same as any system:** maintenance and water quality are essential (small orifices).

THE BALANCE Most limitations are about knowledge, not technology, and knowledge can be fixed.

Take-aways

THE ONE RULE

A water mist system is valid only inside the parameters in which it was fire tested and documented in the DIOM manual.

Mature

≈ 35 years, nearly 100% of large passenger ships, a €1.5+ bn industry.

Tested

Every system proven by full-scale fire test; you design inside that envelope.

Standardised

Especially EN 14972 series (See IMWA Standards Matrix)

Familiar

Far most of design questions work as in sprinkler design. DIOM vs. Presprective standars is the only difference

Supported

IWMA Water Mist Guide, Design Guide, Matrix and many others.
Visit www.iwma.net

Your next step?

Joining IWMA is a good way to get to the inner circle and reaching material first. IWMA Conference is an excellent way to meet the industry and stakeholders

Thank you!

Max Lakkonen

Connect LinkedIn or fireprotectionunlocked.com