



EV & Lithium-Ion Fires in Car Parks

Engineering Resilient Infrastructure
with Water Mist Systems

VID FIREKILL[®]

EXECUTIVE SUMMARY

Electric vehicles have transformed mobility - and reshaped the fire risk landscape in underground and multi-storey car parks.

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Traditional fire protection systems were designed around internal combustion engine vehicles with less hazardous construction materials. But lithium-ion battery fires behave differently:

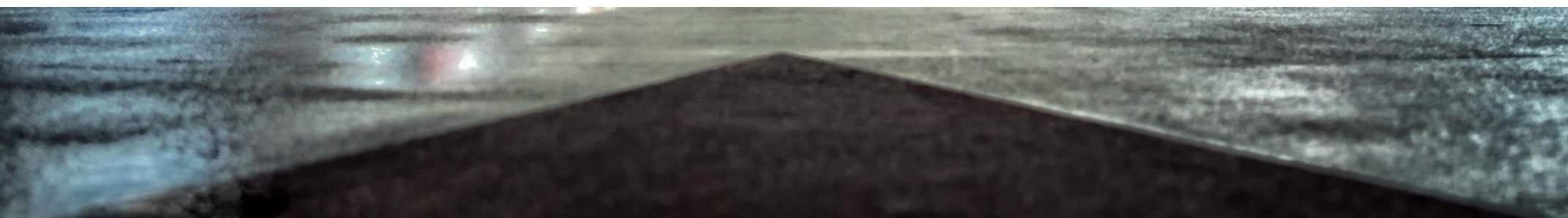
- more energy release
- faster escalation
- longer burn times
- higher peak temperatures
- re-ignition potential
- toxic off-gassing (HF, SO₂)

This new hazard profile places unprecedented stress on structural elements, mechanical ventilation, smoke control, traditional sprinkler systems and older water mist fire test protocols.

Low-pressure water mist systems directly address these challenges, offering:

- rapid cooling and fire control
- certified performance on EV and mixed-vehicle fire tests
- low water consumption (up to 80% less than sprinklers)
- high efficiency in low ceiling environments
- underground garages, EV charging areas
- strong regulatory and insurance acceptance

This document guides designers, consultants, insurers and authorities in understanding the evolving risks - and implementing certified, future-ready protection strategies.



THE TRANSFORMATION OF VEHICLE FIRE RISKS

Lithium-ion battery fires introduce a fundamentally different hazard profile.

Abrupt fire dynamics

EV fires escalate suddenly. Internal cell failures can trigger thermal runaway with:

- jet flames
- rapid flame projection
- localized radiant heat spikes
- structural impact within seconds

Extreme temperatures

Peak temperatures in EV thermal runaway exceed those of ICE fires by a wide margin. Structural concrete, steel beams and MEP containment suffer accelerated thermal degradation.

Long-duration burning

A traditional ICE fire may last 20-30 minutes. EV fires can burn for hours, even with external suppression.

Re-ignition risk

Battery modules may reignite minutes or hours after the "initial knockdown, complicating fire brigade intervention.

Toxic gases

HF and other corrosive gases jeopardize:

- occupants
- first responders
- mechanical ventilation systems
- EV charging infrastructure

These dynamics require a suppression system capable of localized cooling and sustained control

- not just initial knockdown.



WHY CAR PARKS ARE PARTICULARLY VULNERABLE

Underground and urban car parks amplify the severity of EV fires.

Increased ceiling heights

Typical clearances of 3-4 m limit:

- fire penetration
- spray pattern development
- effective coverage

Mist performs reliably in these confined geometries.

Retrofitting constraints

Older structures often lack:

- space for large-diameter sprinkler pipes
- water storage for high-flow systems
- pumping capacity

Low-pressure mist, with its compact pipework and low water demand, fits where sprinklers simply cannot.

Complex obstructions

Beams, ducts, pipes and signage obstruct sprinkler spray patterns – creating shadow areas and delaying activation.

Mechanical ventilation mismatch

Ventilation systems designed for ICE exhaust and traditional smoke patterns struggle with:

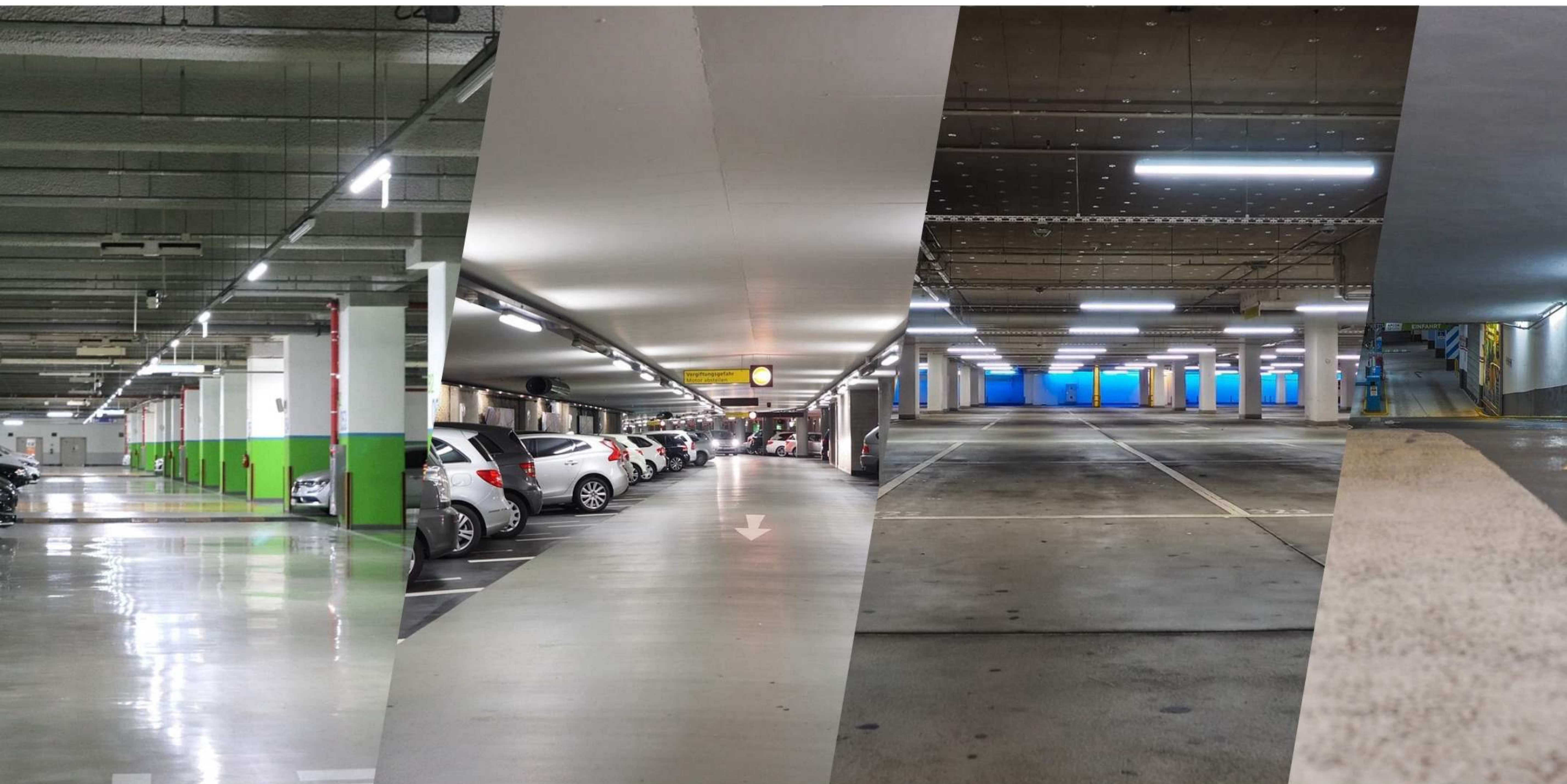
- instant smoke density spikes
- unpredictable stratification
- HF concentrations requiring higher dilution

Mixed-use building dependencies

Water damage, smoke propagation and structural heat stress can rapidly compromise:

- residential floors above
- retail areas
- offices
- transit or tunnel connections

Car park protection is not isolated – it's part of a larger urban resilience challenge.

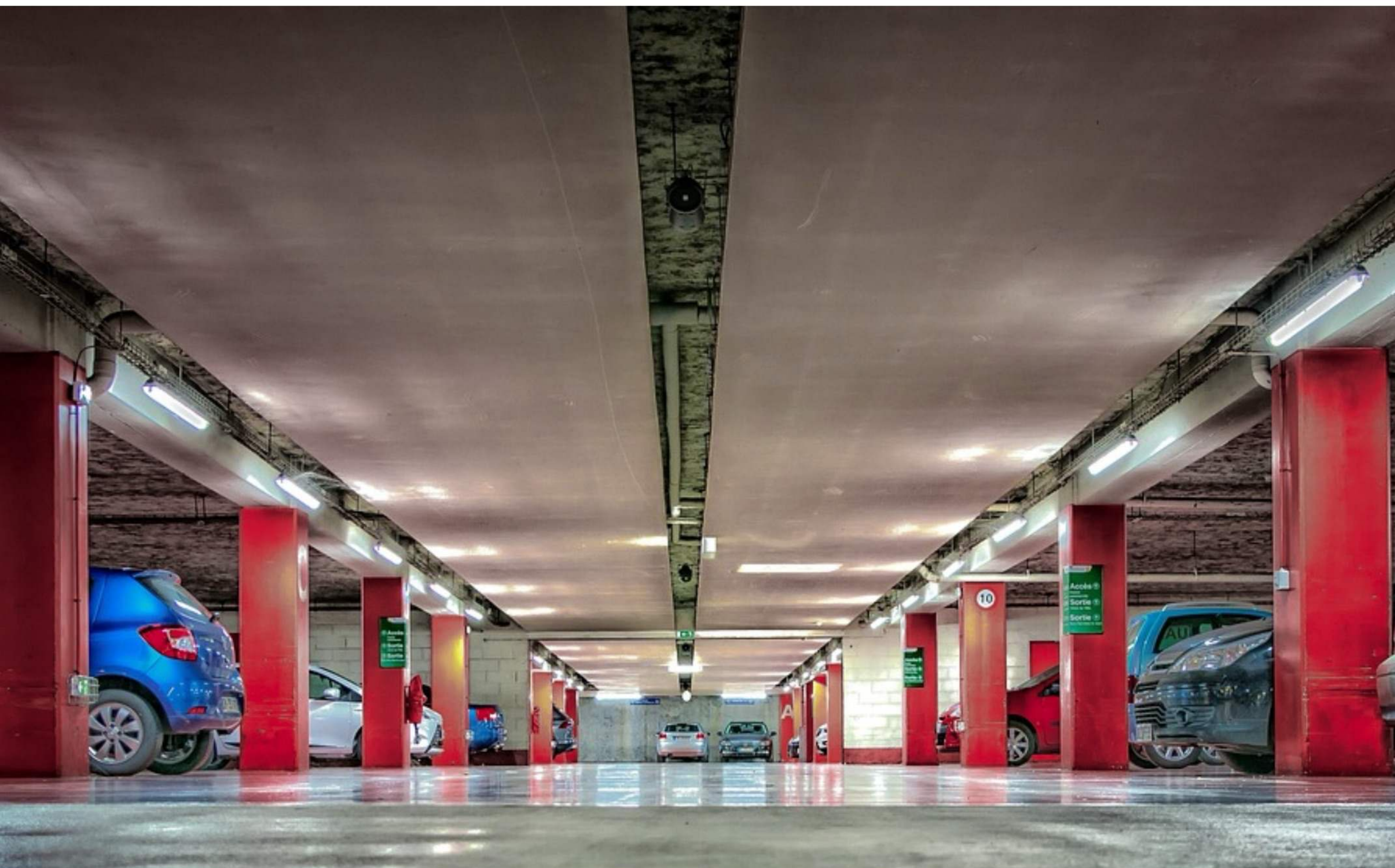


THE CASE FOR FM APPROVED WATER MIST IN EV CAR PARKS

How water mist works

- Rapid cooling: fine droplets evaporate quickly, reducing temperature at the flame zone
- Oxygen displacement: vaporization creates localized steam
- Localized suppression: sprays target the source more directly than sprinklers
- Minimal water damage: essential for multi-storey car parks above critical functions

FM Approval validates performance, reliability and manufacturing quality
— providing confidence for insurers and authorities.



ENGINEERING BENEFITS IN URBAN & UNDERGROUND STRUCTURES

Low-pressure water mist offers unique engineering advantages.

Compact pipework

Small-diameter stainless steel pipes avoid clashes with:

- beams
- HVAC ducts
- signage
- cable trays
- charging station infrastructure

Low hydraulic demand

Mist systems require drastically less water:

- up to 80% reduction compared to sprinklers
- smaller water tanks
- smaller pumps
- easier retrofit into existing buildings

Minimal runoff

Unlike sprinklers, mist reduces:

- water damage to EV chargers, control panels and electronics
- flooding risk in underground levels
- contamination of drainage systems

Faster installation

MT of installation is consistently lower due to:

- lighter pipework
- modular pump units
- simplified mounting

Ideal for retrofits with tight construction windows.



SUITED FOR MODERN APPLICATIONS

Water mist integrates seamlessly into:

- underground car parks
- multi-storey garages
- EV charging areas (slow/fast/ultrafast)
- automated parking systems
- robotic/stacker systems
- mixed-use residential & commercial basements
- tunnel-based parking
- airports and rail hubs

The system is adaptable for new build and retrofit – and for areas where space, water supply or structural capacity are limited.



COMPLIANCE, INSURANCE & GLOBAL ACCEPTANCE

EV-related risks are driving regulators and insurers to seek solutions with validated performance.

FM Approved Water Mist:

- simplify approval by authorities having jurisdiction
- provide insurers with clear, test-backed evidence
- standardize protection across multi-country portfolios
- are widely accepted in performance-based designs
- align with global frameworks (NFPA, European standards, APAC performance codes)

As EV penetration grows – and as buildings become denser and more vertically integrated – FM Approved mist offers a roadmap to compliance without expanding water infrastructure.



SUSTAINABILITY & LIFE-CYCLE COST BENEFITS

Sustainability is now part of every car park design brief. Mist systems deliver advantages in:

Water use

Up to 80% less water → reduced water storage and energy use

Material efficiency

- lightweight distribution networks
- less steel → lower embodied CO₂

Energy performance

Low-pressure pumps minimize electrical load

Maintenance & testing

- reduced corrosion risk compared to traditional sprinkler networks
- fewer mechanical components
- simplified inspections

Overall TCO

Lifecycle cost is significantly lower than high-capacity sprinkler systems — especially in constrained environments.



CONCLUSION

The rise of electric vehicles requires a rethinking of fire protection strategies—especially in underground and urban car parks.

EV battery fires introduce higher heat release rates, violent flame behavior, toxic gases and long-duration events. Legacy sprinkler systems are often misaligned to these new conditions, and many buildings lack the structural or hydraulic capacity to support them.

FM Approved low-pressure water mist systems offer:

- certified for new generation of vehicles
- low water demand
- high efficiency under low ceilings
- adaptability to complex geometries
- easier retrofit in constrained spaces
- global regulatory and insurance acceptance

For developers, designers and operators, water mist is more than an alternative — it is a future-proof solution for the electric era.





Design safer car parks for the electric mobility era.

Learn how FM Approved low-pressure water mist systems protect EVs, infrastructure and multi-storey buildings with certified, efficient and sustainable performance.

- 👉 Download full specifications
- 👉 Request a design-in session with VID engineers
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