Electric Vehicle Charging Mitigating Fire Risk

- Molecular vs Mechanical
- Compliant Encapsulator Agents
  - NFPA 18A – Annex 4.3
  - NFPA 18A – Section 7.7
  - ISO 3941: 2026 – New Class L Fire
- Technology
- Direct and Indirect Consequences
- Challenges and Equipment Sizing
- 18 FEB 2026 – E-Bus Accreditation Certification Test
  - Largest lithium-ion battery fire to date - 700KWh
- Comparing Agents
  - Improving Water
- Testing and Accreditations
  - International Advocates

NFPA-Compliant Encapsulator Agents

NFPA 18A Annex 4.3

2022

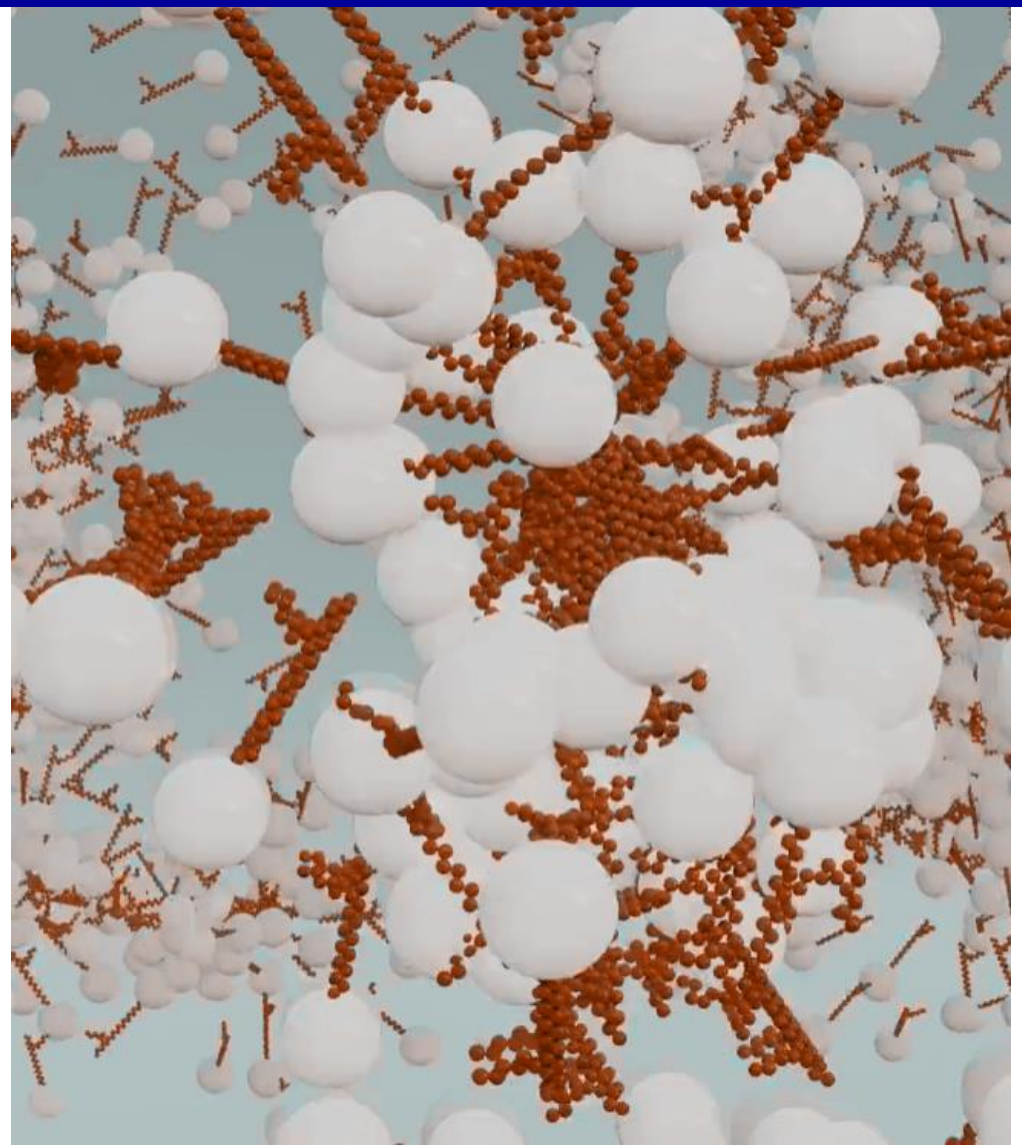
Encapsulator Agents are recognized for over 17 years of extensive third-party testing documenting lithium-ion battery fire suppression as well as the encapsulation of flammable electrolyte and reduction of explosive and toxic vapors. Testing demonstrates the ability to stop thermal runaway propagation.

NFPA-Compliant Encapsulator Agents

NFPA 18A Section 7.7

2022

NFPA 18A, Standard on Water Additives for Fire Control and Vapor Mitigation, is the first of its kind. It outlines the criteria an agent must meet to be classified as an Encapsulator Agent. The Spherical Micelle Stability Test protocol in Section 7.7 evaluates an agent's ability to encapsulate fuel.



Evolving Battery Codes & Standards

NFPA 855

2026

Standard for the Installation of Stationary Energy Storage Systems

This standard provides the minimum requirements for mitigating the hazards associated with ESS.

NFPA 800

Proposed

Battery Safety Code (PS)

Public input for this standard has recently closed. To follow its progress, go to www.nfpa.org and search NFPA 800.

What ISO Says About Class L Fires

4 Class L

"Fires involving lithium-ion cells and batteries, where no lithium metal is present. Note: Class L fires are electrochemical fires that, by comparison to most class A, B, C, D, and F fires, have a greater energy density that can result in a faster growth rate when released."

5.7 Related to Class L

"In addition to the fire hazard, there are several additional potential safety hazards, including venting of hot and explosive gases, toxicity of the gases, presence of physical obstruction(s) that hinder the agent from reaching the seat of the fire source, cascading thermal runaway which is uncontrollable heat transfer from cell to cell, projectile expulsion of hot and/or burning cell(s) from the fire source and/or exposure to leaking electrolyte. Stranded energy, which remains in damaged cells after initial firefighting efforts, can cause reignition and pose an electric shock hazard. Damaged rechargeable lithium-ion batteries connected to a power source can pose an electric shock hazard."

Direct Consequences

Injuries, Fatalities, and Damage

Community Economic Impact

Business Interruption

Loss of Revenue and Market Share

Indirect Consequences

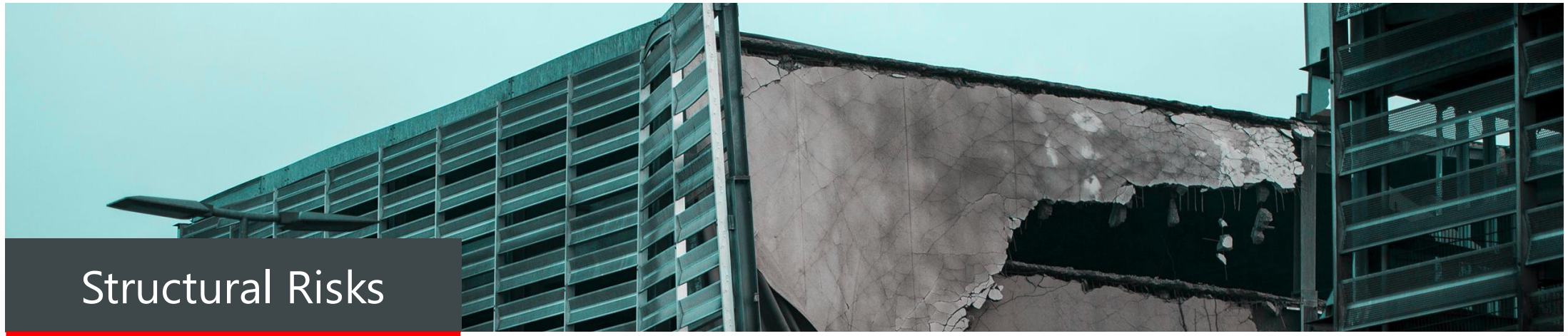
Environmental Pollution and Fines

Class Action Lawsuits

Insurance Coverage Increase or Loss

Damaged Reputation

Fire Protection Challenges in 2026



Structural Risks			
Modern Combustibles	Plastic/Rubber	Adhesives/Chemicals	Lithium-ion Batteries
Lightweight Construction	Truss Roofing	I Joist Flooring	Oriented Strand Board
Compromised Atmospheres	Explosive Off-gases	Toxic Off-gases	PAHs
Volatile Environments	Early Fire Spread	Faster Flashover	Frequent Collapse

Sizing The Correct Fire Equipment

Small

For first line of defense against incipient fires only.

Medium

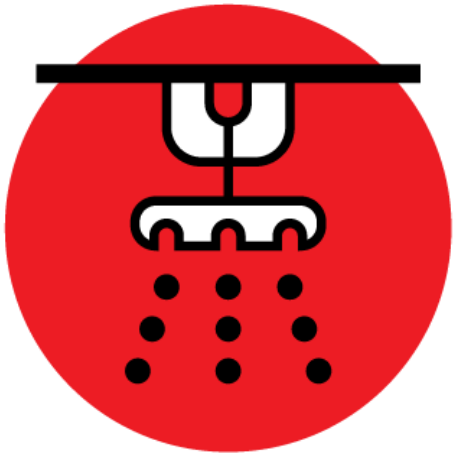
For manual firefighting within confined spaces.

Large

For manual firefighting on standby in high-risk areas.

Oversized

For all encompassing and fixed fire protection.



Test Results

700 kWh

~500°C (932°F) → ~100°C (212°F)
3-5 Minutes

"The suppression system proved its effectiveness, achieving control of the fire in the first few minutes, preventing spread to the adjacent vehicle, and maintaining structural integrity."

Case History

Applus+ Testing with F-500 EA®

Madrid, Spain

In February 2026, HCT Europe partnered with Madrid Regional Transport Consortium (CRTM) to conduct the largest lithium-ion battery fire test to date, extinguishing a 700 kWh electric bus with the F-500 EA® Diamond Doser®.

Applus+ Tunnel Safety Testing for E-bus Fire Suppression with F-500 EA®

Project Coordination	Madrid Regional Transport Consortium (CRTM)
Test Instrumentation	Applus+ Laboratories Tunnel Safety Testing (TST)
Test Material(s)	Alsa Electric Bus (700 kWh GDV Battery)
Design and Installation	Iberext (Elitex Protection)
Fire Suppression	F-500 EA® Diamond Doser® (Powered by Firemiks®)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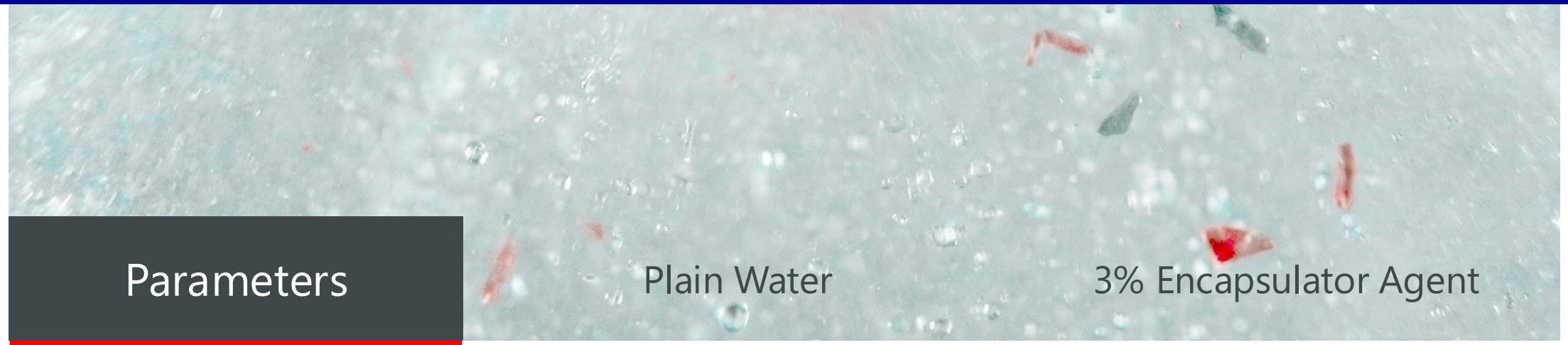
Comparing Fire Suppression Agents

Parameters	Clean Agents	Water	Encapsulator Agent
Application Method	Only Single Discharge Application	Single or Continuous Discharge Application	Single or Continuous Discharge Application
Agent Versatility	Only Addresses Flammable Hazards	Only Addresses Flammable Hazards	Addresses Flammable, Explosive, and Toxic Hazards
Enclosure Requirement	Only Effective in Enclosed Environments	Effective in Enclosed and Open Environments	Effective in Enclosed and Open Environments
Life Safety	Unsafe to Discharge Around People	Safe to Discharge Around People	Safe to Discharge Around People

Encapsulator Agent is Improving Plain Water



Parameters	Plain Water	3% Encapsulator Agent
Endothermic Process	Steam Conversion Absorbs Thermal Energy Slowly	Thermal Conveyance Absorbs Thermal Energy ~10x Faster
Water Requirement	Testing and Real-world Applications Site a Copious Amount of Water	Testing and Real-world Applications Site ~60% Less Water
Environmental Impact	A Copious Amount of Runoff is Generated (Heavy Metals, Etc.)	Encapsulates Toxins and Impurities in Smoke, Soot, and Runoff
Economic Impact	Damages to Neighboring Communities Leads to Legal Action	Prevents Damages During and After Fire Suppression

Testing and Accreditations

Trusted by Leaders

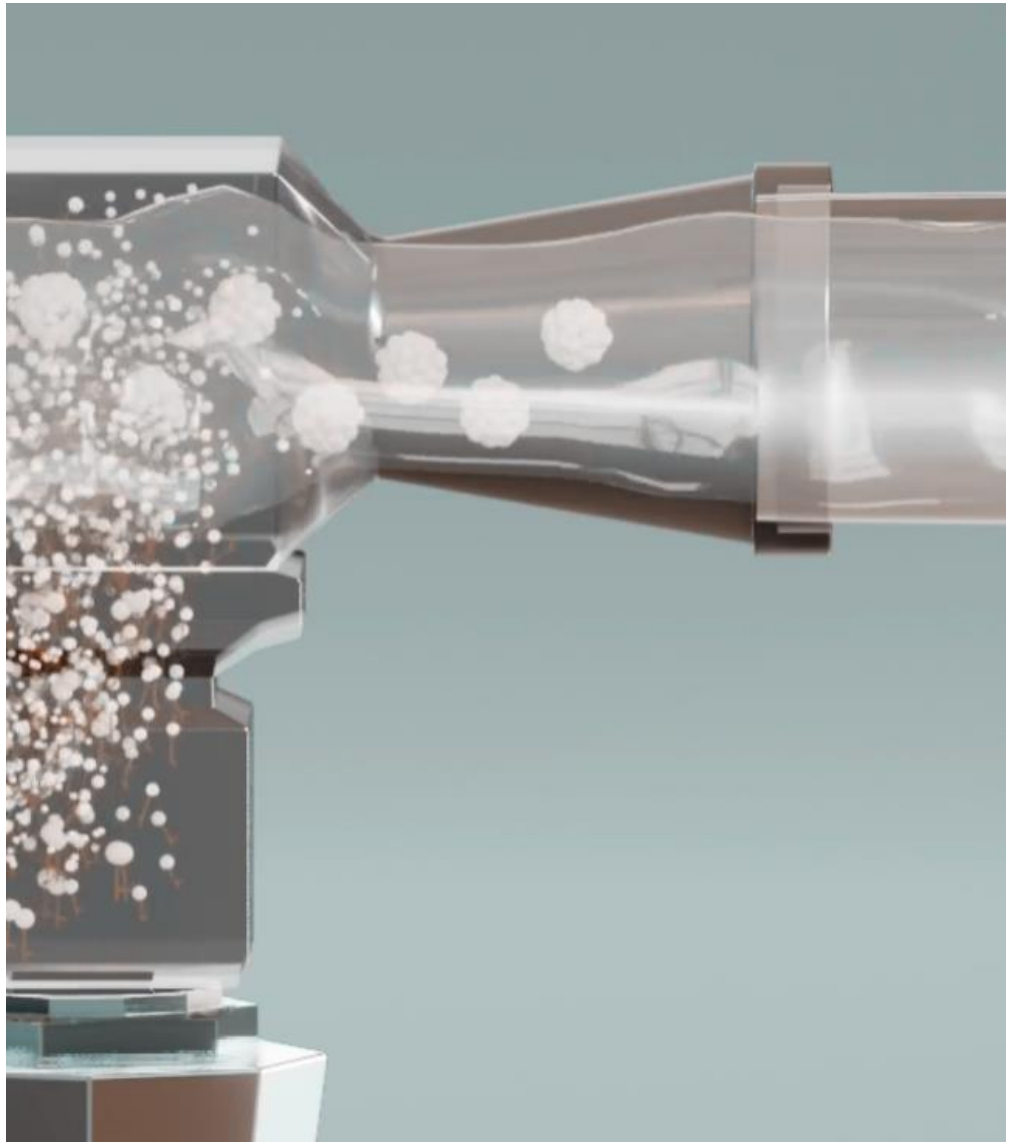
Encapsulator Agents

Superior Protection & Versatility

Mitigates multi-class and three-dimensional fire, vapour, flammability, explosivity, contamination, and toxicity risks.
- One-time or continuous discharge

Environmental Impact

- Fluorine-free,
- Biodegradable
- Noncorrosive
- Reduce environmental impact and costly disposal fees
  - combining performance with sustainability.



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