FOGTEC®
FIRE PROTECTION

FOGTEC WATER MIST SYSTEMS

EFFECTIVE, ECO-FRIENDLY AND SUSTAINABLE FIRE PROTECTION

FOGTEC COMPANY

- Owner-managed company
- Established in 1997 in Cologne, Germany
- Team of mainly engineers
- More than 45 partner companies all over the world
- Experts in engineering and design of complex fire fighting and fire detection systems
- Services include
    - Consulting
    - Development of fire protection concepts
    - Validation in full scale fire tests
    - Manufacturing and software development
    - Component supply and installation
    - Service and maintenance



FOGTEC BUSINESS UNITS

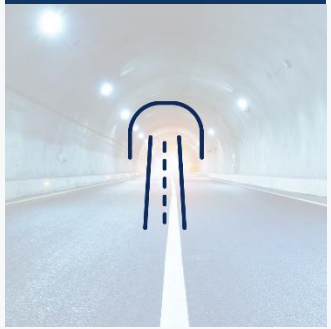
FIXED SYSTEMS

Water mist systems for buildings, machines and industrial applications

RAIL SYSTEMS

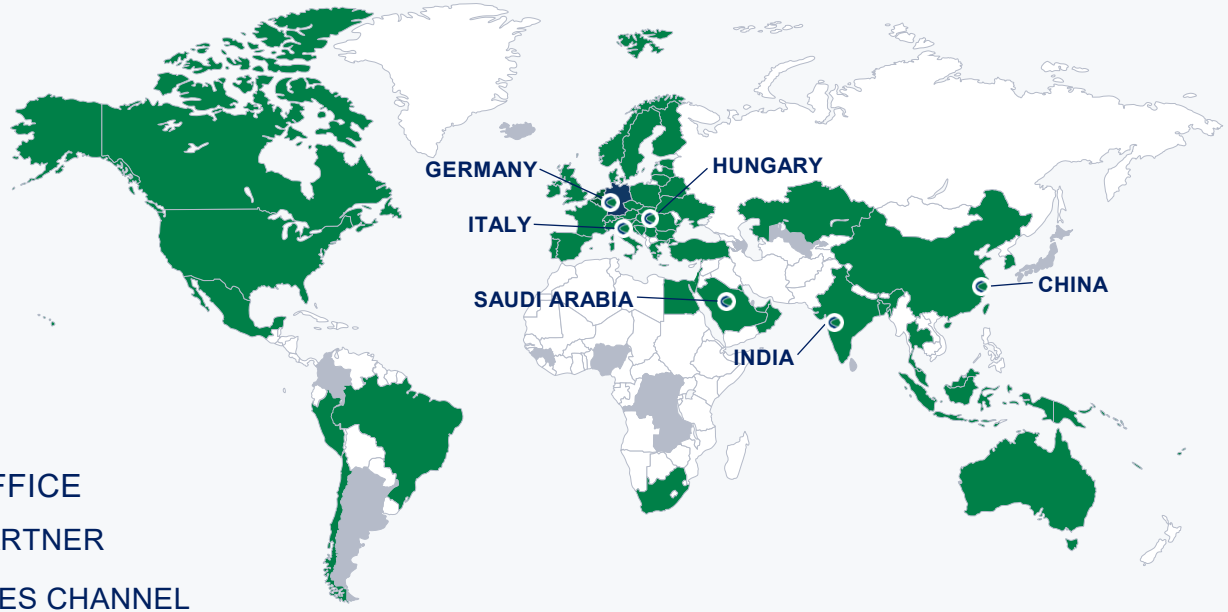
Smoke detectors and fire fighting systems for rolling stock

TUNNEL SYSTEMS



Fire fighting systems for tunnels

GLOBAL MARKET PRESENCE



- FOGTEC OFFICE
- FOGTEC PARTNER
- OTHER SALES CHANNEL

GUIDELINE WORK AND RESEARCH PROJECTS

Member of VdS 3188 Water Mist Committee

Board Member of International Water Mist Association

Member of Fire Industry Association

Member of bafsa UK Water Mist Committee

Member of 3 European Norming Institute Committees incl. EN 14972

Member of 3 DIN Norming Institute Committees incl. DIN EN 14972

Member of National Fire Protection Association Committee 750 and 502

Member of CNPP / APSAD French Water Mist Committee

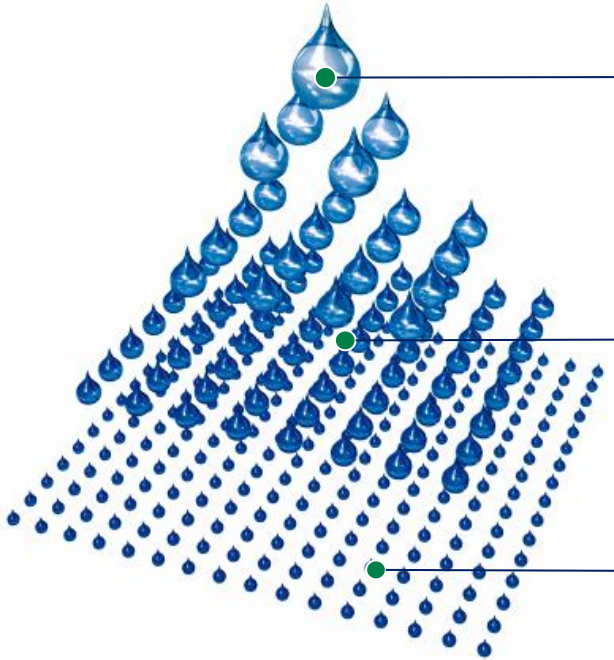
Managing Party of Fire Protection Research Project for NEC

Managing Party in 2 Research Projects

Board Member of ITA COSUF International Tunneling Association

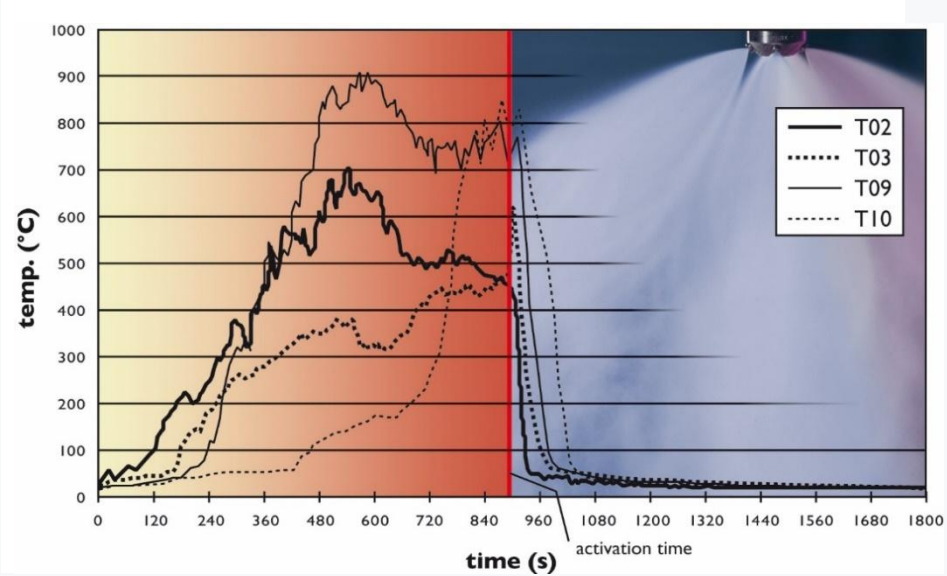
EXTRACT OF OUR CUSTOMERS

SMALL DROPLETS – BIG EFFECT



DROPLET DIAMETER	REACTION SURFACE PER LITRE OF WATER
1MM	2m² CONVENTIONAL TECHNOLOGIES
0.1MM	20m²
0.01MM	200m² WATER MIST

HIGH COOLING EFFECT



- Highest cooling effect due to minute droplets
- Optimal fire suppression
- Immediate limitation of fire propagation
- Improved evacuation and fire services approach
- Protection of building structures (e.g. exposed glass facades)

ENERGY BINDING POTENTIAL OF 1 L OF WATER

- **335 kJ heating from 20°C to 100°C**
- **2257 kJ transition from liquid to gas**

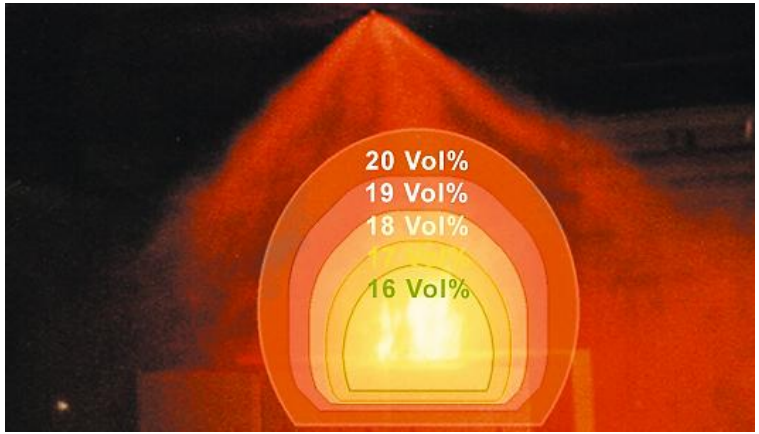
INERTING BY LOCAL OXYGEN DISPLACEMENT

Oxygen displacement of at the fire source

1 L - Liquid

1650L - Gaseous

VOLUME ENLARGEMENT OF 1 LITRE OF WATER BY EVAPORATION



OXYGEN REDUCTION ONLY AT THE SOURCE OF THE FIRE

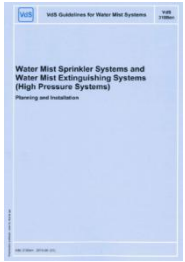
WATER MIST AS ALTERNATIVE TO SPRINKLERS

- Building operators often afraid of large water usage of conventional sprinklers due to water damages to valuable goods, electric equipment and to areas not directly affected by a potential fire
  - High pressure water mist systems require 80% to 90% less water
  - Minimal impact on valuable goods and electric components by water mist
- Substantial infrastructure requirements to accommodate large water storage tanks and water distribution pipes in false ceilings with conventional sprinkler systems
  - Water mist systems utilize small break tanks with < 5000 l volume
  - Pipe sizes range between 12 mm and 50 mm for main raisers

WATER MIST AS ALTERNATIVE TO GAS EXTINGUISHING

- Operators often concerned for personnel safety and larger fire damages in conjunction with pre-warning times for gas extinguishing systems
    - Water mist is safe for personnel
    - Water mist systems can be discharged immediately on fire detection without pre-warning times
- Enclosure requirements to build-up gas concentration difficult particularly for retrofit installations
    - Water mist systems are tolerant to room openings
- Operators are afraid of re-ignitions in conjunction with large fires
    - High cooling effect of water mist prevents re-ignitions

STANDARDS AND APPROVALS



- System tested and certified based on international standards such as NFPA 750, EN 14972, VdS 3188, FM 5560
- Approvals include individual full scale fire tests for different applications and respective component tests
- Water mist is the only fire fighting technology being 100% fire tested
- Design, installation, operation and maintenance (DIOM) manuals are produced for each application

KEY COMPONENTS

Water Mist Nozzles

- Nozzle type determined by full scale fire tests
- Open nozzles in deluge systems
- Glass bulb operated nozzles in wet pipe, pre-action and dry-pipe systems
- Made of corrosion resistant materials and fitted with adequate filtration

Water Mist Hydrants

- Water mist gun evaluated in full scale fire tests
- Effective fire fighting with minimal water quantities

SECTION VALVES AND PIPEWORK

Water Mist Section Valves

- Section valves for deluge, wet, pre-action and dry-pipe systems
- Equipped with manual override and test devices
- Made of corrosion resistant materials

Water Mist Pipework

- Small diameters, particularly for high pressure water mist systems
- Corrosion resistant stainless steel material
- Long lifetime
- No contaminated water when discharged

WATER SUPPLIES

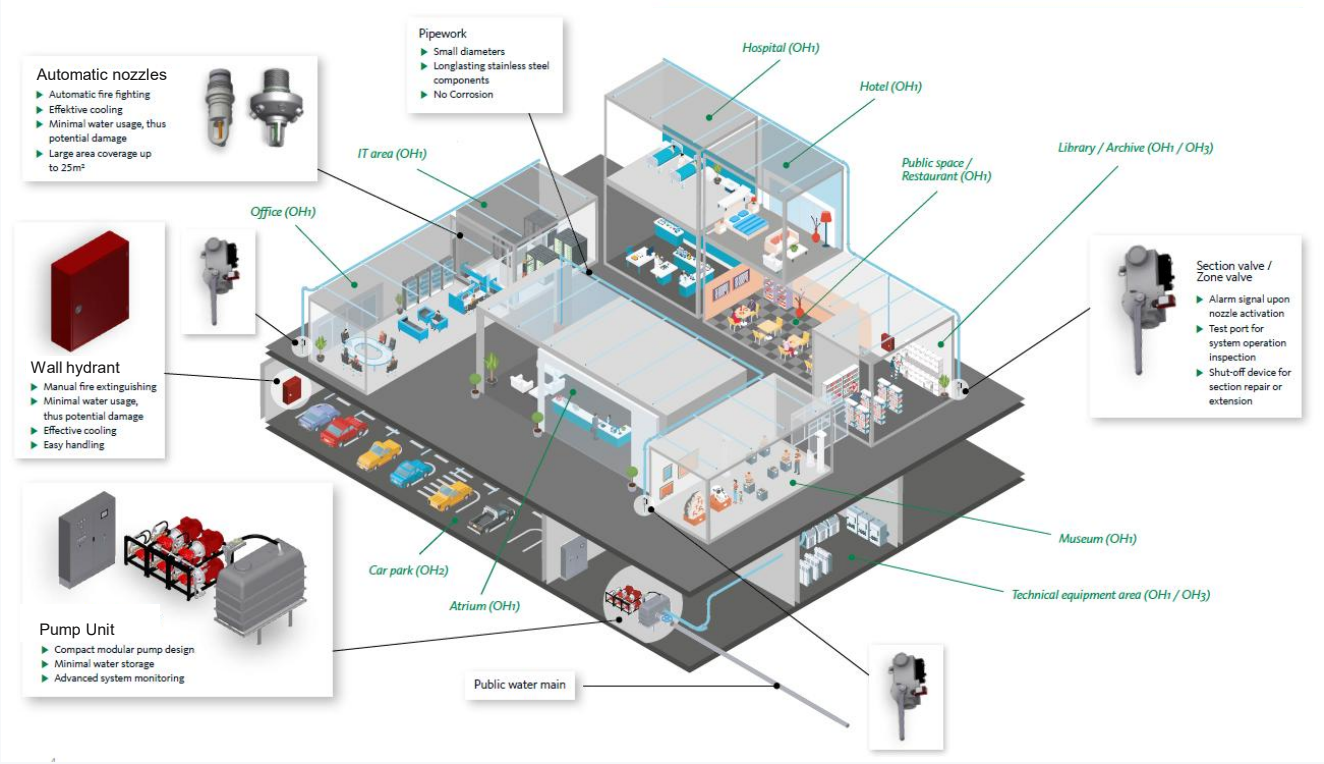
Cylinder Systems

- Water cylinders with internal lining
- Nitrogen as propellant
- Manual release or activation by fire alarm system
- Stand alone system

Pump Systems

- Modular concept for high pressure water mist systems
- Power supply by electric motor or diesel engine
- Small break tanks with < 5000 l volume for high pressure water mist systems

WATER MIST SYSTEMS FOR BUILDING PROTECTION



WATER MIST SYSTEMS FOR PRESTIGIOUS BUILDINGS

Customer motivation to decide for water mist

- High cooling effect / Compensation of structural fire protection
- Effective prevention of fire spread
- Minimal water discharge / Minimal water damage
- Protection of valuable goods and building structure
- Small pipe sizes / Small water storage tanks
- System can easier be integrated into the architecture of the building

REFERENCE PROJECTS HIGH RISE BUILDINGS

Gasometer in Berlin (Germany)



- Protection of the entire high rise building with 78 m height

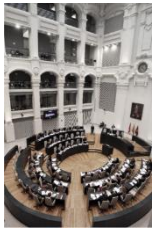
Clock Tower in Mekka (Saudi Arabia)



- Protection of the 600 m high building including an astronomical museum, prayer rooms and technical areas

REFERENCE PROJECTS HERITAGE BUILDINGS

Town Hall Cibeles in Madrid (Spain)


- Protection of the entire heritage building

Palace at St. Mark Square in Venice (Italy)



- Protection of the entire heritage building

REFERENCE PROJECTS MUSEUMS & CONCERT HALLS

Egyptian Museum in Turin (Italy)

- One of the largest Egyptian collections with 30.000 exhibits
- Protection of all exhibition areas and offices

Elbphilharmony in Hamburg (Germany)

- Protection of the concert hall
- Special fire protection concept with floor mounted nozzles

REFERENCE PROJECTS LIBRARIES & ARCHIVES

Technical Library in Prague (Czech Rep.)



- Protection of the entire library building
- Special nozzle arrangement for atrium protection

EMOC National Archive in Paris (France)


- Protection of 200 archives of each 200 m^2 and the adjacent office building

WATER MIST SYSTEMS FOR HOSPITALS AND HOTELS

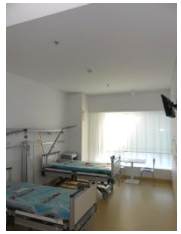
Customer motivation to decide for water mist

- High cooling effect / Compensation of structural fire protection
- Effective prevention of fire spread
- Easier evacuation
- Minimal water discharge / Minimal water damage
- Minimal down times
- Small pipe sizes / Small water storage tanks
- System can easier be integrated into the architecture of the building

REFERENCE PROJECTS HOSPITALS

Landesklinikum in Baden (Austria)





- Protection of the entrance area, patient rooms and escape routes of the hospital

University Hospital in Amsterdam (Netherlands)


- Protection of a hospital complex

REFERENCE PROJECTS HOTELS

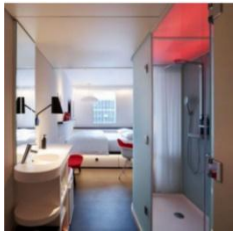
Radisson Blu Hotel Schwarzer Bock in Wiesbaden (Germany)



- Protection of the entire heritage building with 142 hotel rooms

Citizen M Hotel in Zurich (Switzerland)





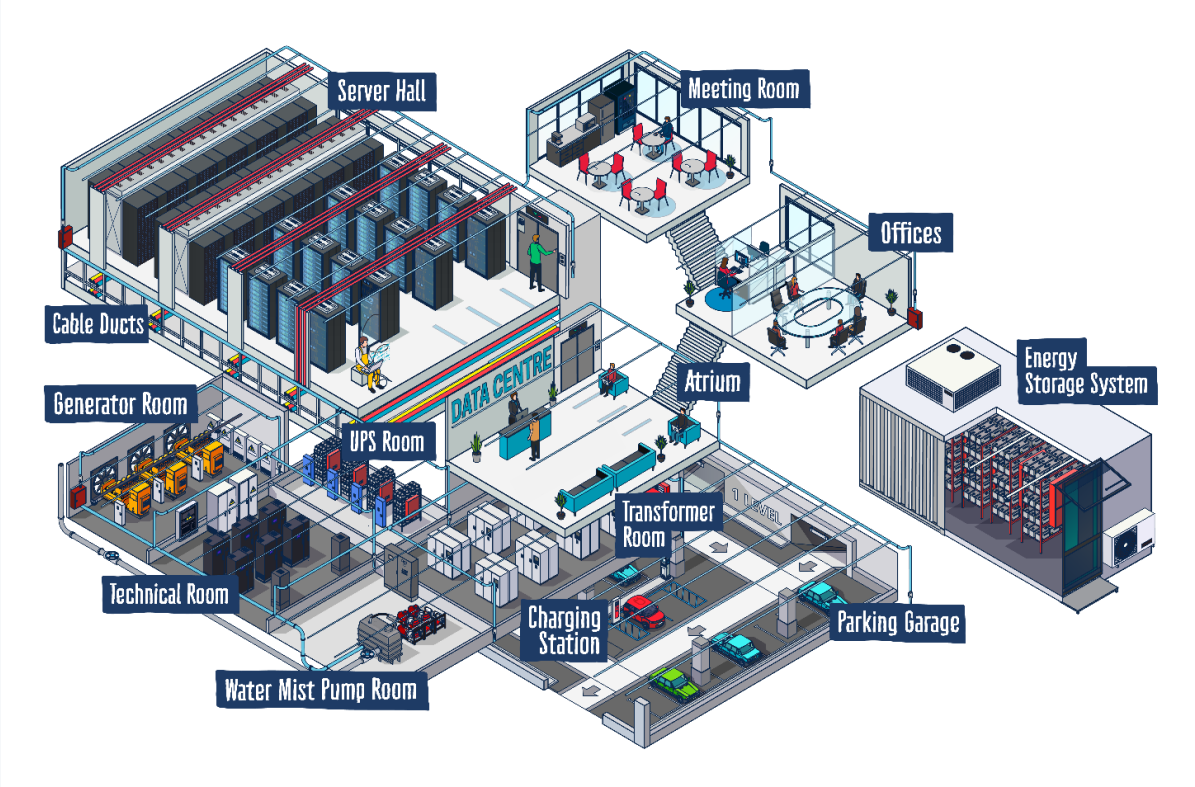
- Protection of the entire hotel with 155 guest rooms

WATER MIST SYSTEMS FOR DATA CENTRES

Customer motivation to decide for water mist

- Proven fire suppression / Cooling of adjacent areas to the fire
- Safe for operators / No pre-warning times
- Negligible effect on electric and electronic equipment
- No requirement for ventilation shutdown
- High flexibility for system integration / Scalability
- One system for all applications
- Smoke scrubbing effect
- Minimal downtime after system activation

HOLISTIC WATER MIST DATA CENTRE PROTECTION



REFERENCE PROJECTS DATA CENTRES

Telecity in Frankfurt (Germany)

- Protection of the entire Internet Service Provider data centre

Royal Bank of Scotland in Edinburgh (UK)

- Protection of 3 data centres

REFERENCE PROJECTS DATA CENTRES

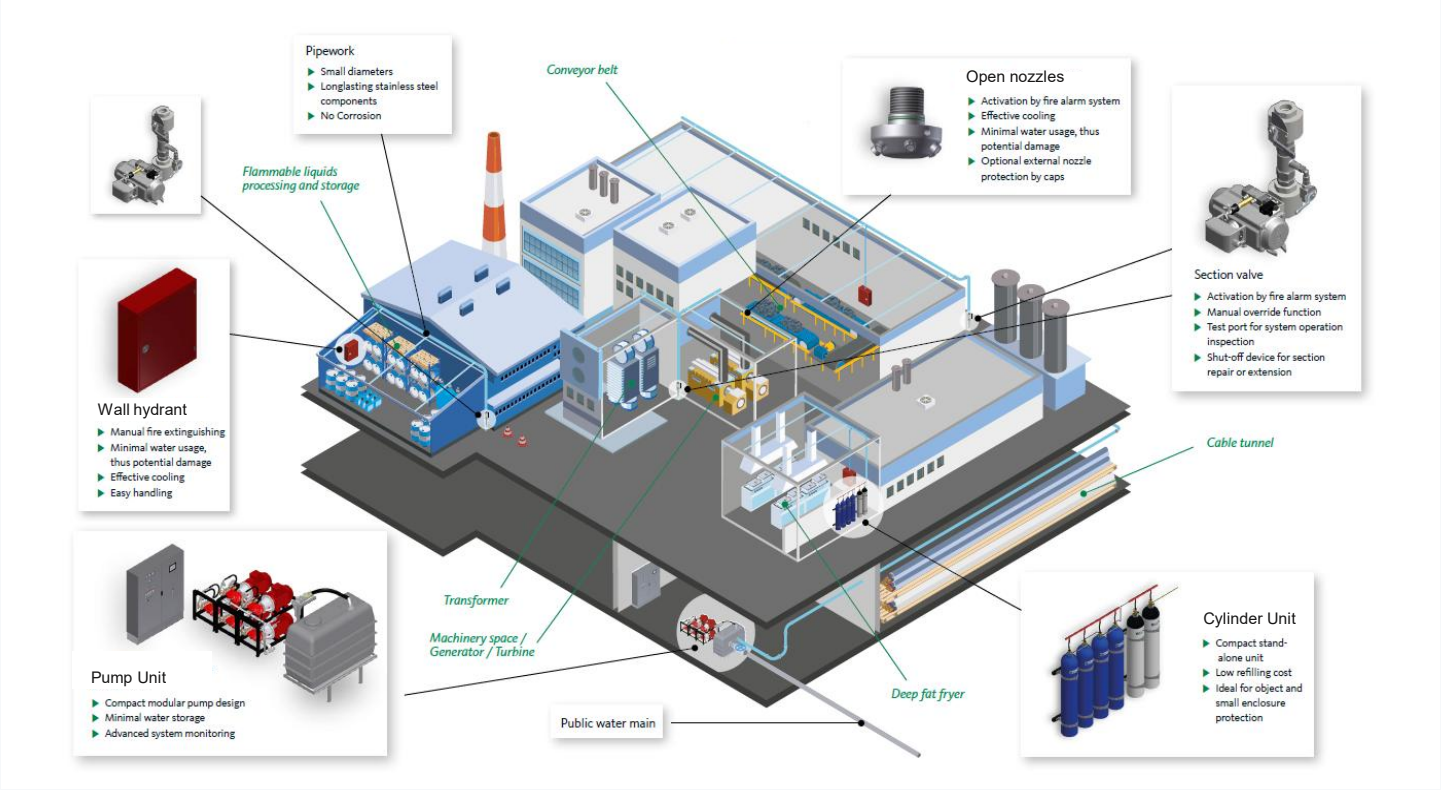
Bank La Caixa in Torija-Guadalajara (Spain)

- Protection of two entire data centres

Apple in Ulanqab (China)

- Protection of the entire data centre with 100.000 m^2

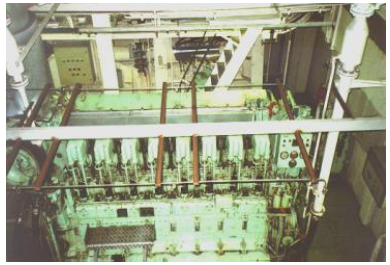
WATER MIST SYSTEMS FOR INDUSTRIAL RISK PROTECTION



WATER MIST SYSTEMS FOR MACHINERY PROTECTION

Customer motivation to decide for water mist

- Rapid extinguishment
- Effective cooling / Preventing re-ignitions
- Safe for operators / No pre-warning times
- Minimal business interruption
- High flexibility for system integration
- Typical risk areas
    - Generators
    - Turbines
    - Transformers
    - CNC machines
    - Flammable liquids processing



REFERENCE PROJECTS MACHINERY & LIQUID STORAGE

Daimler AG - Motorenhaus III in Stuttgart (Germany)

- Protection of 72 engine test benches

Votteler in Stuttgart (Germany)

- Protection of a production and storage facility in a paint factory

REFERENCE PROJECTS GENERATOR & TRANSFORMERS

DEWA Sub-Stations in Dubai (UAE)

- Protection of 42 transformers (132 kV) in 6 sub-stations

Cevahir Shopping Mall in Istanbul (Turkey)

- Protection of diesel power generators

REFERENCE PROJECTS MACHINERY

Prinovis in Dresden (Germany)



- Protection of 5 retro-gravure printing machines

ThyssenKrupp AG in Duisburg (Germany)



- Protection of 180 m long electrolytic steel coating machine

WATER MIST SYSTEMS FOR POWER INFRASTRUCTURE

Customer motivation to decide for water mist

- High cooling effect
- Safe for operators / No pre-warning times
- Smoke washing effect
- Minimal water usage
- Negligible effect on electric and electronic equipment
- Short business interruption
- Easy space saving installation

REFERENCE PROJECTS POWER INFRASTRUCTURE

Main Train Station in Cologne (Germany)

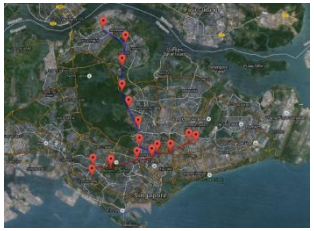
- Protection of the entire cable tunnel network under the train station with ca. 1600 m length

Bayer Factory in Krefeld (Germany)

- Protection of the entire cable tunnel network in the production plant with ca. 1800 m length

REFERENCE PROJECTS POWER INFRASTRUCTURE

Singapore Power SP (Singapore)



- Protection of 35 km long power transmission cable tunnel with 6 m diameter
- Specific large scale cable tunnel fire tests have proven the efficiency of the system

Chongming Cable Tunnel in Shanghai (China)

- Protection of 2 x 7,5 km long power supply cable tunnel to the Chongming island

WATER MIST SYSTEMS FOR TRAFFIC INFRASTRUCTURE

Customer motivation to decide for water mist

- High cooling effect
- Smoke washing effect
- Minimal water usage
- Short business interruptions
- Easy retrofit / Small water storage requirements
- Typical risk areas
    - Metro Stations
    - Road Tunnels
    - Rail Tunnels
    - Car Parks
    - Bus Depots

REFERENCE PROJECTS TRAFFIC INFRASTRUCTURE

Metro Line M2, M3 and M4 in Budapest (Hungary)



- Protection of 36 underground metro stations, the train depot and the main control tower
- In each station the platforms, escalators, cable tunnels and technical rooms have been protected

City Tower Car Park in Koblenz (Germany)


- Protection the entire car park including the electric vehicle charging areas

REFERENCE PROJECTS ROAD AND RAIL TUNNELS

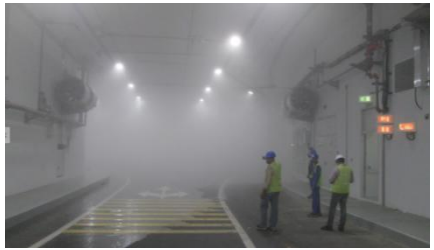
Eurotunnel, France / UK

Road Tunnel M30 in Madrid, Spain

Virgolo Tunnel, Italy

New Tyne Tunnels, UK

Dartford Tunnel, UK



Saadiyat Tunnel in Abu Dhabi, UAE

REFERENCE PROJECTS ROAD AND RAIL TUNNELS

Waldtunnel, Austria

Al Rough Tunnel, UAE

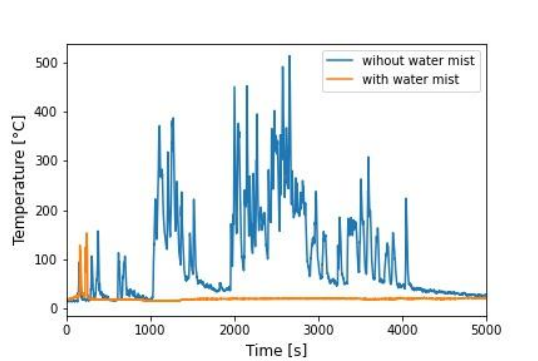
Ismailia Tunnel, Egypt

Hugh L. Carey Tunnel in New York, USA

PROJECT SUVEREN

Fire Protection for Li-Ion Batteries

- Identification of current and future risks related to the use of new energy carriers in underground urban transport
- Fire testing with lithium-ion batteries
- Comparison between different detection methods and extinguishing agents



Temperature development during fire test

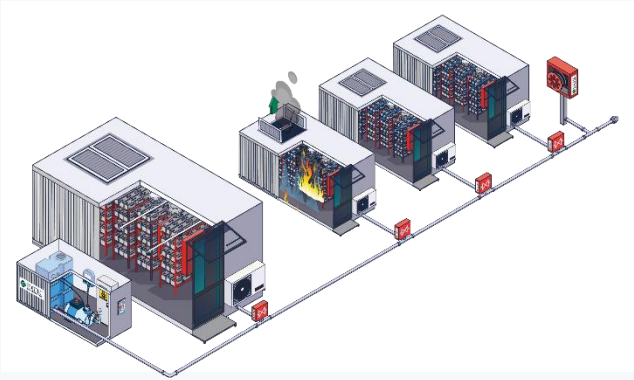
Supported by:

Federal Ministry of Education and Research

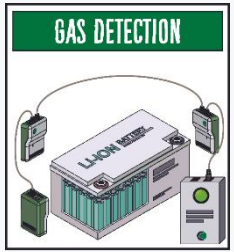
on the basis of a decision by the German Bundestag

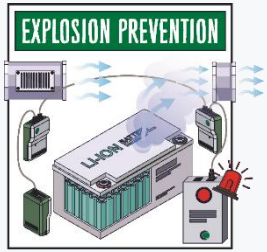
WATER MIST PROTECTION FOR LI-ION BATTERIES

Energy Storage Systems



- Early venting gas and thermal runaway detection
- Active venting of explosive gases
- Effective cooling by water mist
- Protection of the energy storage infrastructure
- Limiting fire spread to adjacent batteries modules





LI-ION BATTERY VENTING GAS SENSOR

FOGTEC Gas Detection System

- Developed on the basis of research results from SUVEREN 2use
- Sensors continuously monitor the ambient
- Easy installation and commissioning thanks to single-cable wiring
- Central unit with display and integrated memory

ENERGY STORAGE SYSTEMS

- Battery storage systems for commercial use at two locations in Germany
- Both BESS are installed in buildings
  - 200m² with a capacity of approx. 7,5 MWh and an output of approx. 1,2 MW
  - 690m² with a capacity of approx. 27 MWh and an output of approx. 4,8 MW
- The battery rooms are equipped with
  - Battery gas detection
  - Smoke aspiration systems
  - Smoke and heat extraction
  - High-pressure water mist firefighting system

REFERENCE PROJECTS CAR PARKS

SUVEREN Fire Tests for Car Parks

- Fire tests with electric vehicles as part of the SUVEREN research project

City Tower Car Park in Koblenz (Germany)

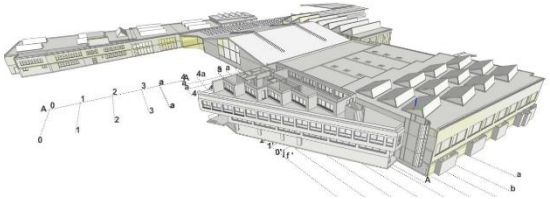
- Protection the entire car park including the electric vehicle charging areas

REFERENCE PROJECTS BUS DEPOTS

SUVEREN Fire Tests for Bus Depots

- Fire tests for depots with electric buses as part of the SUVEREN research project

Bus Depot in Bern (Switzerland)



- Protection of the depot with electric buses

BENEFITS OF WATER MIST TECHNOLOGY

Safe for people / No pre-warning time required

Sustainable and environmentally friendly technology through 100% pure water

High cooling effect / Reach of hidden fires

Negligible effect on electric components

Minimal water consumption, thus consequential water damages

Small pump rooms and water tanks

Minimal operation interruption

Space saving installation and retrofit with small bore pipes

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