

FIRE SAFETY IN SUBURBAN RAILWAY STATIONS

First-ever use of a water mist system for smoke management and life safety in underground stations

Underground transport facilities place special demands on fire protection. In three S-Bahn stations in Germany, between Frankfurt am Main and Offenbach, a high-pressure water mist system has been installed for the first time, which specifically influences smoke behaviour in the event of a fire. The aim is to reduce smoke accumulation and significantly extend the time available for evacuation and rescue operations.

SMOKE AS A KEY HAZARD IN UNDERGROUND TRANSPORT FACILITIES

Fires in underground transport facilities pose major challenges for emergency services and operators worldwide. Events such as the fire at King's Cross Underground Station in London in 1987 remain in the collective memory to this day and have vividly demonstrated how quickly smoke can spread in enclosed infrastructure and how crucial controlled smoke extraction is for the safe evacuation of passengers.

Against this backdrop, technical solutions are gaining in importance that can specifically influence smoke behaviour in addition to firefighting. A current project in three suburban railway stations in the Frankfurt and Offenbach area, Germany,

demonstrates the possibilities that modern high-pressure water mist systems can offer in this context.

A FIRST FOR UNDERGROUND RAILWAY STATIONS

In the Deutsche Bahn underground S-Bahn stations of 'Kaiserhof', 'Ledermuseum' and 'Marktplatz', located between Frankfurt am Main and Offenbach main station, a high-pressure water mist system has been installed for the first time specifically for the purpose of smoke management.

The main objective of the system is to specifically reduce smoke build-up within the stations in the event of a fire, thereby significantly extending the time available for rescue operations. Particular focus is placed on the so-called 'third-party rescue time', i.e. the period during which fire service personnel can still effectively rescue people who are unable to leave the station unaided.

Additionally, the water mist system suppresses the fire, therefore keeping it at a small level until further intervention by the fire brigade.

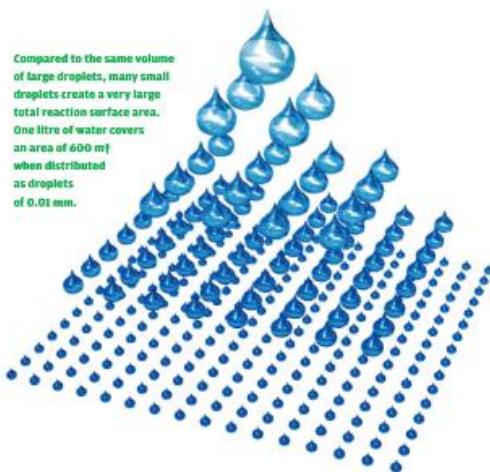
TYPICAL CONSTRUCTION WITH SPECIFIC CHALLENGES

The three stations feature a typical design for underground transport facilities: the track level is located below



The underground Ledermuseum station in Offenbach features one of Germany's first high-pressure water mist smoke management systems installed specifically for passenger protection in underground rail infrastructure. Deutsche Bahn AG / Andreas Varnhagen

Compared to the same volume of large droplets, many small droplets create a very large total reaction surface area. One litre of water covers an area of 600 m² when distributed as droplets of 0.01 mm.



with an intermediate level above it housing, among other things, vending machines and access points to the surface.

In the event of a fire, smoke initially rises from the track level to the intermediate level before it can escape to the open air. For passengers, this means comparatively long escape routes, which can quickly fill

with smoke without additional measures.

Analyses carried out during the planning phase showed that the available external rescue times would be insufficient in an emergency. Without additional measures, it would not be possible to reliably meet the requirements for maximum permissible smoke

concentrations or the time needed for the safe evacuation of the railway stations.

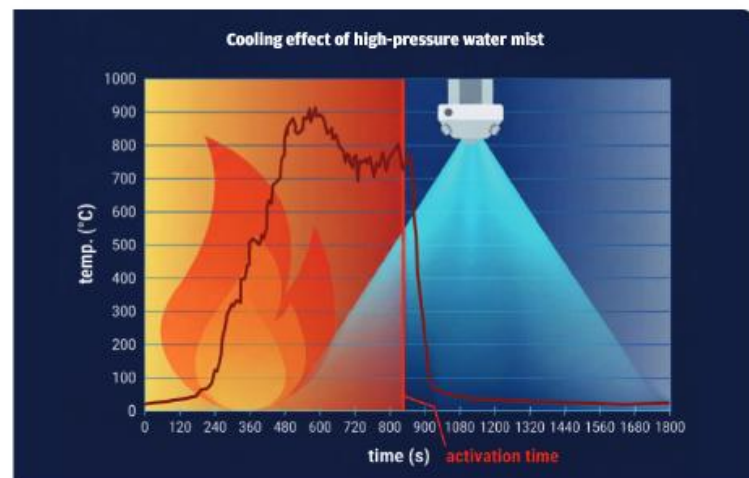
Potential fire incidents can occur both inside the station and be caused by vehicles. Train fires are considered particularly critical. If a vehicle catches fire in the tunnel, train drivers are often instructed to continue to the next station. This can carry a fire directly into the station.

HIGH-PRESSURE WATER MIST AS A SUITABLE SOLUTION

Fire tests and detailed analyses ultimately confirmed the suitability of a high-pressure water mist system for this application. The system installed by the manufacturer FOGTEC generates extremely fine water droplets that produce several effects simultaneously.

On the one hand, the fire is fought; on the other, smoke and soot particles are partially bound and the flue gas temperatures are significantly reduced. This not only reduces the volume of smoke but also influences the spread of the flue gases. With appropriate system design, the spread of smoke can be specifically slowed down.

Alternative approaches were also investigated. However, structural alterations or mechanical smoke extraction systems proved either unfeasible or significantly more costly. Furthermore,



such measures do not actively influence the volume of smoke generated.

Against this background, the decision was made to install a high-pressure water mist system from FOGTEC.

SYSTEM DESIGN AND TECHNICAL IMPLEMENTATION

In each of the three stations, the system was implemented as a stand-alone unit. Despite the limited space available, the entire technical infrastructure could be accommodated within the stations. Pumps, power supply, water storage and main pipes were integrated into existing plant rooms.

Part of the system's technical equipment is located in the trough area beneath the platforms. The pumps were lowered into the designated spaces with millimetre precision via former ventilation shafts.

Stainless steel pipes with very small diameters run along the station ceiling from the main pipe. These pipes supply water to special high-pressure nozzles. Each station was divided into several fire suppression zones.

In the event of a fire, the fire alarm system automatically activates three sections: the area where the fire was detected, as well as the two adjacent sections. This ensures that the water mist is directed only to the areas where it is needed. This zone-by-zone activation makes it possible to keep pipe dimensions and water requirements relatively low.

The pipework and nozzles were installed beneath the station ceiling and also along the platform edges. This allows a fire to be tackled from both above and below. In the event of an incident, the respective section pipes are supplied with water via remotely controllable valves.

INSTALLATION DURING ONGOING OPERATIONS

The installation of the system presented the project team with significant logistical challenges. Installation work could mostly only take place at night or during operational breaks, and in some cases required the complete closure of individual sections of track.

Close coordination with Deutsche Bahn and precise timing of the individual work stages were therefore essential. Some materials were transported just-in-time by freight train to keep construction times as short as possible and avoid unnecessarily disrupting ongoing operations.

CONTRIBUTING TO GREATER SAFETY IN PUBLIC TRANSPORT

The installation of a high-pressure water mist system in the three Offenbach S-Bahn stations marked the implementation of a new approach to fire protection in underground transport facilities. The system improves conditions for evacuation and third-party rescue, thereby enhancing safety for passengers, railway staff and emergency services.

There are also practical benefits for the operator: the retrofitting could be carried out with relatively short closure periods, and the investment costs remained significantly lower than those of alternative solutions.

The project thus serves as an excellent example of the possibilities that modern high-pressure water mist technology can offer in the fire protection of complex transport infrastructures. ●



For more information, go to www.fogtec.com



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