IN CASE YOU *MIST IT*

Managing Editor Rebecca Spayne explores some of the suppression systems in place to help best protect important property

Even with all the advances made in fire safety technology and procedures in recent years, property still continues to be needlessly destroyed by fire. Of course, assuming that we will reach an age where fires are a thing of the past is a fool's gambit, but currently it seems that too many buildings and properties fall victim to what inquests reveal to be easily preventable measures. The proper installation of even the most rudimentary suppression systems in a public building can be invaluable in preventing long-term damage to the property and can even aid in other more indirect ways, like helping to disperse harmful smoke from the area. When combined with other fire safety measures, like a smart alarm system and properly installed fire doors, any commercial or large-scale building becomes nigh-impregnable to fire.

The immediate and hidden benefits of fire suppression systems formed a central talking point at the International Water Mist Association Conference, held late last year in Madrid. Featuring a host of water suppression experts and scholars all under one roof, the event serves as the perfect forum to compare results from water-based suppression system tests, especially pertaining to water mist, and formulate plans for the future.

Water mist is an intriguing development within the suppression space, offering the same amount of extinguishing ability as conventional droplet suppression (some would argue with much better results), while using much less water than the previously mentioned systems. While this is not only a more environmentally-friendly option for businesses and probably works out to be cheaper in the long run, another huge boon for water mist suppression is that it is able to be deployed in areas where droplet sprinklers would damage equipment and infrastructure. Some ideal applications for water mist systems include in data rooms, where damage to the server computers caused by water can be absolutely catastrophic to businesses and critical infrastructure. Thankfully, the data itself is very easy to retrieve these days; it's more the combined damage to rows upon rows of expensive, powerful machines that is the biggest casualty felt in the case of fires in these rooms. The companies to go to for protecting your data centres from both the elements of fire and water include Tyco Fire Protection Products, Aquasys and Danfoss Semco.

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It's not just modern buildings with the latest in cutting-edge technology that benefit from this protection though - heritage sites such as churches and historical buildings also benefit. Due to the delicate nature of their construction and the materials used in them, it would be prudent to reduce the chance of water damage to the structure, which in this case can be just as devastating as fire damage. Examples of companies that specialise in protecting heritage sites with their suppression technology include Marioff and Johnson Control.

There's no better example of this than the tragic Notre Dame fire that occurred in 2019. Despite having plenty of renovations and innovations built upon the foundation of the cathedral since its initial construction in the 12th century; none of those included fire curtains or fire suppression technology. The result of this neglect speaks for itself. What's perhaps the most tragic part of all, however, is that the timber used to construct Notre Dame is nigh-on impossible to find today, as the trees of which the timber came from no longer grows to the same sizes and strength as it did in the 12th century. Really, I could not have picked a better example of the exact kind of clientele that water mist suppression provides the greatest benefit for.

Regardless, I digress. Another crucial final benefit of water mist technology when compared to its more conventional water droplet compatriot, is that water mist suppression not only uses water to directly deal with the fire, but that the resulting thick mist that envelops the room is also able to remove oxygen as well. This applies not only to oxygen, but other harmful aerosols and contaminants in the air (as we will see with some scientific studies later). This final point is up for contention, though, as a legitimate benefit over water droplet suppression: one could argue that the sole cause of any suppression system, from the humble fire extinguisher to a household fire blanket, all the way up to a firefighter's hose pumping out gallons of suppressive foam, is that it is starving the fire of oxygen. To remove a fire, you must either remove the oxygen or its fuel source. No product on the market targets the fuel source (how could you?), so every product has starving fire in mind when it's being designed. With this belief, then, we can say that water mist suppression is no different to any other product.

Maybe the way forward, like the approach that firefighting foams has taken, then, is to combine the water with another element to maximise

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the extinguishing ability. Joseph Perry, a private Research and Development Consultant, explored this premise in the latest International Water Mist Conference, using water mist technology with nitrogen to create a firefighting “bomb” that was specialised for fighting wildfires.

As Perry put it in his paper: “The combination of climate change and the expanding human development in the wildland-urban interface create devastating fires that are burning and spreading more quickly than they did 30 years ago. To retard these fires, fire-retarding material is typically dropped into, or in front of the advancing fire from aircraft such as helicopters or airplanes. To be effective, the conventional Aerial Firefighting dropping must be performed from an altitude no higher than 60 m above the treetops. But such low flights are extremely difficult and dangerous, particularly at night. Most of the aviation-related wild-land firefighting fatalities result from failure to maintain clearance from terrain, water, or objects. The FFB can be dropped from any appropriate altitude and can be activated at the most effective distance above the fire.

“The basic Fire Fighting Bomb structure is similar to the conventional aerial bomb. The explosive fill is replaced by a solid propellant (Sodium-azide) and a bulk of water. The heavy high fragmentation steel body is replaced by a biodegradable material or an aluminium shell. Once the requisite threshold is reached or exceeded, the FFB fuse activates the detonator resulting in gas bursts into the water tank, forcing the bomb shell to open. The opened FFB releases a huge fire-retarding aerosol cone precisely at an optimal level above the fire, resulting in effective rapid extinguishing, while using significantly less water as compared to conventional methods.”

With scrutinous eyes permanently on firefighting foams and the effect they have on the environment, these water mist bombs may be the most effective and sustainable option for fighting wildfires going forward, as companies and institutions race to find solutions that are free of harmful fluorine before they are banned totally; with the amount of wildfires on the rise, too, it is more pertinent than ever for companies to get the best of both worlds for wildfire defence. The fact that these prototype bombs can be deployed from a greater height and reduce the rise of operator casualties is just another bonus.

Another pressing matter in the fire industry is the long-term harm smoke and other contaminants as a direct result of fire can have on the people fighting it. It was just announced recently that several firefighters on the site of the Grenfell Tower disaster five years ago have been diagnosed with terminal cancer. The brief period of time it has taken for this tragic illness to claim these firefighters victim speaks to the sheer volume of carcinogens they were exposed to at the time of the fire. While PPE and suppression technology has come a long way, the war now lies beyond the front lines, with cleaner firefighting solutions being imperative to ensuring the longevity of the service. With the way things are going, soon there will be no one willing to enter such a high-risk profession - action needs to be taken now. This is where one of the hypothesised strengths of water mist suppression brings it into the spotlight: its ability to cleanse danger areas of toxic gases.

I spoke to Kemal Arsava, Senior Research Engineer at RISE Fire Research, who put forward one of his studies he conducted to investigate the correlation between water mist suppression and toxic gases in a fire-stricken area. Included below is the abstract for this study: there is more

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for the researchers to discover in this study, and their findings will no doubt be presented to other professionals at the next International Water Mist Conference, held once again in Madrid towards the end of this year.

INFLUENCE OF WATER-BASED SUPPRESSION SYSTEMS ON GAS TOXICITY

Kemal Sarp Arsava and Lei Jiang

Fire Research and Innovation Centre (FRIC) started in the Spring of 2019 and has the vision to obtain improved fire safety of people, reduced risks for fire and rescue services, reduced fire loss of properties and values, and reduced negative impact on the environment. As one of the FRIC projects, this study focuses on the effects of water-based suppression systems on smoke toxicity.

A deeper understanding of smoke and toxicity from real fires is central to improving safety in building fires and will facilitate better knowledge-based decision-making. This study, performed at RISE Fire Research, experimentally investigated the burning behaviour and gas emissions of a compartment fire (~ 1 MW) with and without a water-based suppression system. Various sprinkler and water mists nozzles (low and high pressure) with different water pressures are tested. A 210 cm long, 210 cm wide, and 210 cm deep shipping container is used for testing (Figure 1). For each test, a stack comprising one plastic (at the top) and two wood Euro-pallets placed at the centre of the container is used as fuel to achieve the desired heat release rate (HRR) (Figure 1b). The plastic pallet is made of high-density polyethylene (HDPE). The stack of pallets is ignited by a standardised method. The gases are measured with a Fourier-Transform Infrared Spectroscopy (FTIR) that is capable of measuring CO, CO_2, O_2, N_2O, NO, NO^2, SO_2, NH_3, HCl, HF, HCN, CH4, C_2H_6, C_2H_4, C_3H_8, C_6H_{14}, CHOH and can operate in high humidity. The development (0-4 minutes), suppression (after activation), and dilution (post-fire) of the gases are recorded. Temperature measurements at several points in the container have been carried out using 11 thermocouples (TCs) (Figure 1c-d). The preliminary results demonstrated that the suppression systems were effective in extinguishing the fire, lowering the ambient temperatures, and reducing the amount of produced toxic gases due to early extinguishment. A detailed analysis is still in progress. The findings of the study and a comprehensive discussion will be published in mid-2023.

Closing thoughts

Water mist suppression has become an exciting new prospect in the fire safety space, offering a swath of advantages over its older, water droplet-based cousin. While fundamentally the methodology remains the same - dispersing water to cool and eventually suffocate a fire the moment it breaks out - a change as simple as the size and shape of the water particles is enough to bring with it its own hidden benefits. As society becomes more advanced, ushering in an age of digitisation, we are finding more and more sensitive and expensive equipment on site for businesses. Likewise, as infrastructure evolves, essential cabling that serves as proverbial capillaries for densely-populated areas must remain functional and protected against fire, as even the smallest amount of damage to these cables could disrupt society on a large scale - and may even cost the lives of those dependent on it. Water mist may be the protective measure that infrastructure like these need.

It’s not just modern facilities that need special care, either - the Notre Dame fire in 2019 serves as a grim reminder that the smallest spark can result in the irretrievable loss of one of the most iconic heritage sites on Earth. Had water mist systems been installed alongside the other renovations the building had benefited from over the years, perhaps there would be a different story to tell.

The point is that water mist has its place in the fire safety space, and the International Water Mist Conference serves as the focal point to discuss the potential that this technology provides. If you would like to explore some of the studies and discussions held at last year’s show, many of the academic abstracts and scientific papers presented are available online at the IWMA’s website. Take heed of water mist - it may quickly become the de facto fire safety solution in the coming years. FB