

Special Smoke Scrubbing

By Dr. G. Muehlenbruch

Member: IWMA

Fire Safety Technology Center, Vahldorf, Germany

As Mr. Mawhinney stated in his article "Smoke Scrubbing", scrubbing of smoke cannot be done by simply spraying of water mist. Actually, there is no automatic fire extinguishing system, which is suitable for the improvement of the visibility. It might have been the largest step to forget the fire and to focus on the behavior of the smoke. The tested plant was designed according to the principles of an industrial plant. Therefore the design has to be focussed on

- an optimum of placing the nozzles
- an optimum of droplet size
- use of ventilation.

Generally fire-extinguishing systems are not designed to consider the roof region and the velocity of the droplets is normal to the smoke stream. The right combination of the size and velocity vector of the droplets is necessary in order to absorb the soot. Additionally, a minimum of ventilation has to be used in order to increase the oxygen concentration.

There are four main endangering sources in the case of tunnel fire:

- toxic gases and reduced oxygen concentration
- reduced visibility
- irritation of the respiratory tract
- high temperatures.

Independent on visibility or temperature a high concentration of toxic gases or a low concentration of oxygen may cause death. So these concentrations have to be influenced.

The reduced visibility increases the breathing frequency and the exposing time. Both result in an increased influence of the gas concentrations on the health of the involved people.

High temperatures and high irritation of the respiratory tract causes breath stopping. Even if there is enough oxygen, the people will die in such atmosphere, because the air is not breathable. Breathable does not mean healthy air, but that you can breath.

The classical tunnel concepts are based on a ventilation system only. The ventilation system shall provide a smoke free zone at the bottom between the fire and the next emergency exits. Dependent on the local weather conditions an expensive ventilation system is necessary to reduce the air velocity sufficiently, which means about 1.5 m/s. If it is a plane tunnel, this concept will work well for car fires as we could see in one of our tests. But it doesn't work if the tunnel is inclined or in the case of lorry fires. The fire of a lorry leads to a smoke production of 120 m³/s. This leads to a flow velocity of more than 2 m/s and the flow becomes turbulent, which means smoke free zone can be provided in car fires only. This was seen in our experiments too.



Considering these difficulties, our concept is based on higher velocities. The higher ventilation rate increases the oxygen concentration and reduces the concentration of toxic gases significantly. Additionally, the fire fighters can use the smoke free windward side to come close to the fire. The water mist will reduce the radiation at this side. The more intensive water mist at the leeward side reduces the soot and the dangerous gases, which increases the escaping chances at this side. Infrared light was used to test the visibility during the Selzthal tests. Even at this wavelength a decrease in light absorption could be achieved. In comparison with the visible light, the infrared light is absorbed less in soot but more in water mist. Therefore the visibility must have been more improved. At the same time, the smoked air was breathable. Again I wouldn't say it was a healthy air, but we could breath, because the remaining soot did not take our breath. We are sure, that carbon oxides are not the best soluble agents for water. But while the CO could be reduced by higher ventilation only, there was an additional reduction of 25 % in CO₂ by the use of water mist measurable. Because this amount exceeded the capacity of the solvent, the reason of this reduction has to be investigated. This reduction was seen in the Norway tests too (Brände in Verkehrstunneln - Bericht über Versuche im Maßstab 1:1 (EUREKA-499-FireTun). editor: Studiengesellschaft Stahlanwendung e.V., Düsseldorf, 1998).

International Water Mist Conference in Vienna – A Review

*By M. Ecke
General Manager
Member: IWMA*

(The article was published in the May/June issue of the ifp-magazine. It is for those members who have not subscribed to ifp-magazine)

About 70 fire safety experts attended the first International Water Mist Conference from April 4 to April 6 in Vienna, Austria. In cooperation with independent member institutions, the International Water Mist Association (IWMA) had invited to its first symposium of this kind. The attendees, who came from twenty countries, discussed the present scientific situation concerning fire protection with water mist.

Moreover, the participants exchanged experience regarding existing and new applications of this relatively young fire fighting technology. The experts agreed that the phase-out of the wide spread extinguishing gas halon, because of its critical effects on the environment, has created interest in water mist as a fire-fighting agent. Conventional sprinkler systems are often not an appropriate alternative for those types of applications where halon has been used previously. Even some recently developed chemical fire extinguishing gases might not be an adequate alternative since they also contribute to a heating-up of the atmosphere and can be rated as being critical to the environment.

In general, water mist fire suppression systems can be seen in machinery enclosures, local applications such as motors or transformers, flammable liquid storage areas such as paints and lubricants, computer and data processing rooms as well as in historical buildings, museums and archives. General Office areas are also being equipped more and more with water mist systems.



A presentation by a water mist systems manufacturer explained how a new administration building of an industry facility, which is mainly made of glass and steel, is protected by a water mist fire suppression system. Furthermore, presentations about the installation of water mist systems in tunnels in order to improve the escape chances for persons have been introduced to the audience.

A number of scientific presentations revealed the need to intensify the research activities. It has to be proved in further scientific studies with theoretically based models what has already been verified by numerous 1:1 fire test scenarios: how fires can be fought efficiently by water mist and how lives and material assets can be saved. Among others the Swedish institute SP, the Finish institute VTT, the Norwegian research establishment SINTEF as well as the American Factory Mutual are very active in the field of research regarding water mist.

Another important issue discussed was the current situation concerning standards and regulations. The European standard that the CEN group presently develops was introduced and a comparison between CEN standard and NFPA 750 standard was made in order to explore the main differences. The whole set of regulations of the IMO for marine applications was presented as well. Furthermore, the attendees stressed the demand for design rules, which regulate the use of water mist systems for land-based applications.

Finally it can be said that there is the need to establish an international platform for the water mist community and the people interested in this technology. Members of 20 countries underline this statement. For the time being the International Water Mist Conference will take place annually in order to pursue discussion about the rapid development of water mist technology.

The proceedings of the first Water Mist Conference will soon be available to anyone interested in this subject. Please explore the IWMA home page (www.iwma.net) for further details.

Contact: International Water Mist Association
Am Langen Berg 3
D-39345 Vahldorf (near Berlin), Germany
Phone +49 - 39 202 - 85 200, Fax 250
www.iwma.net contact@iwma.net

Water Mist Workshop in Denver, USA October 10 and 11, 2001

Information by the board

The CCACS (Center for Commercial Applications of Combustion in Space) workshop on water mist fire suppression technology will be held on the campus of the Colorado School of Mines in Golden, Colorado, on October 10 and 11, 2001. This work shop is being organized by the CCACS in cooperation with the U.S. Department of the Navy Office of Safety and Survivability and the International Water Mist Association.



The workshop will bring together product manufacturers, end users, government program managers and university researchers from across the country and abroad to review the current status and future directions of water mist fire suppression technology.

The workshop should be of interest to any company or organization engaged in production of, or research and development related to, water mist fire suppression systems. Water mist systems are under consideration for a variety of applications, including ships, aircraft, and industrial and domestic spaces. There is no registration fee for the workshop, but registration is required, preferably no later than July 1. Interested parties should fill out and submit the response form on the web site of the school.

The address is as follows: <http://www.mines.edu/research/ccacs>

Please indicate in the comments section of the response form if you would like to make a presentation and include a brief description of it. A more complete agenda will be sent out in July, along with directions to the campus and a list of local accommodations. We thank you for your interest and we look forward to a productive and enjoyable workshop.