A review of Water Mist Fire Suppression Technology: Part II - Application Studies

ZHIGANG LIU and ANDREW K. KIM

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Fire Risk Management Program, Institute for Research in Construction, National Research Council of Canada, Ottawa, Ontario, K1A 0R6, Canada

ABSTRACT: The progress on the research and application of water mist technology in fire suppression has been substantial over the last decade. This paper, following our previous review on water mist fundamental studies, reviews recent water mist application for: the extinguishment of Class B spray and pool fires in machinery spaces, gas turbine enclosures, combat vehicles, and flammable liquid storage rooms; the extinguishment of Class A fires in residential occupancies, marine accommodations and public spaces, **heritage buildings** and libraries; the extinguishment of Class C fires in electronic equipment and computer rooms; and the protection of aircraft onboard cabin and cargo compartments. Some new applications, such as the use of water mist for the extinguishment of Class K fires in commercial cooking areas; and the use of water mist as a possible total-ship protection method, as well as the use of water mist for the protection of heavy goods vehicle shuttle trains, are also reviewed. Up-to-date development of corresponding test and design criteria for the installation of water mist fire protection systems and for the evaluation of the capabilities and limitations of water mist for fire suppression in some areas, such as machinery spaces, ship's cabins and corridors, and turbine enclosures, are discussed.

KEY-WORDS: water mist, fire suppression, flammable liquid hazards, class A combustible hazards, **Library Settings**, fire protection for aircraft on board cabin and cargo compartment, electronic equipment, commercial cooking areas.

CHAPTER CONCERNING CULTURAL HERITAGE:

Water Mist in Library Settings (p. 28-29)

The potential to use water mist in heritage buildings and library settings has also been investigated[i,ii,iii,iv] . During fire suppression in library settings, librarians want not only the fire to be effectively controlled, but also water damage to books to be minimized.

Milke and Gerschefski have reported their water mist research for library applications[iii]. The tests were conducted in a 7,92 x 3,96 x 2, 29 m room. Three rows of book shelves with 500 hard and soft bound books were located at one end of the room. The water mist system evaluated in the tests was a single fluid, high pressure system (69bar). The nozzles were installed in the aisles and in the flue space. With the activation of water mist systems, the fire damage of the documents was controlled, and room temperatures quickly decreased. Post-fire observations found that folded newsprint two shelves above the fire had only suffered a minor amount of discoloration along the edge nearest the flue, and the newsprint above this shelf showed no signs of damage.

Mawhinney[iv] further tested a prototype single-fluid / high-pressure water mist system for fixed library shelves, similar to those in the rare book vaults of the Library of Congress in Washington, DC. The fire scenarios included on involving archival materials on shelves, and another involving librarians' materials on a work cart in the center of an aisle. During the tests, two approaches to the design of water mist systems for the protection of libraries were tested: one based on "total compartment application" in which water mist is discharged from open nozzles into all portions of the compartment, and a second based on a "zoned application" in which the compartment is divided into several zones and nozzles in each zone are activated on a signal from the detection system that pinpointed the location of the fire.

For total compartment application in the tests, the fire was controlled when the mist system was activated 50s after ignition. However, the fire was unable to be controlled by water mist when the system was activated 100s after ignition. The test also showed that the majority of the water discharged in a total compartment application was wasted in areas far removed from the fire and caused water damage to the materials.
For the zoned application in the test, the fire spread across aisles was effectively prevented, and the fire and water damage to the materials was minimized (the potentially catastrophic fire was stopped in less then 5 minutes of water application). Zoned water mist application discharged only 30% as much water as sprinklers.

The zoned application showed that water mist is able to either meet or exceed most of the fire suppression performance objectives for a water-based fire suppression system for archival applications. However, the zoned water mist system that is incorporated with detection/logic elements increases the complexity and cost of the system for the protection of library settings. In order to move from the prototype to a finished design of the zoned water mist system, further work will be required to simplify the system, ensure reliability and reduce installations costs.

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