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Fire Protection and Loss Mitigation of High Density Library and Archival Storage

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ABSTRACT

Typical libraries and archival facilities are increasingly challenged by the volume of materials that need to be stored. For that reason, those facilities are turning to high bay, high density shelving arrangements to store a significant portion of their collections. Because of the limited space between rack shelves and also between shelves and the top of the storage containers in these storage arrangements, the water discharge from any in-rack sprinkler is often obstructed. The protection of these types of facilities is critical due to the high value and uniqueness of the materials stored.

The main objective of the featured research was to develop fire protection options for narrow aisle, high bay rack storage of books, and archive boxes for a typical high density storage arrangement. A secondary goal of the project was to develop loss mitigation methods to reduce non-thermal damage imposed on the commodity during a controlled fire or water release. An additional goal, if necessary, was to generate data that could be used to support recommendations for the future design of high density storage modules, and streamline fire protection requirements and the recovery process.

Fire testing of this storage arrangement was conducted both at intermediate- and large-scale. An assessment was made regarding the effectiveness of a combination of in-rack and ceiling level sprinklers to protect this hazard, which was stored to a height of 6.1 m (20 ft) under a 7.6 m (25 ft) high ceiling.

Testing showed that the ceiling level sprinklers in combination with the two levels of in-rack sprinklers were effective at maintaining acceptable levels of fire spread, ceiling level temperatures, water demand and amount of commodity damage. Additionally, the tested combination of ceiling level and in-rack sprinkler protection maintained rack deformation to a degree that was unlikely to lead to rack collapse.

Intermediate- and large-scale testing showed that a substantial amount of damage occurred due to structural failure of the corrugated containerboard book trays. Failure of these trays under water application conditions allows books to fall from the shelves, which greatly increases the amount of non-thermal damage and hampers firefighting as well as clean up efforts.

Results and conclusions from the intermediate- and large-scale fire tests will be presented. Additionally, loss mitigation techniques such as early smoke detection, fire department pre-planning, and a post-incident recovery plan will be discussed.