Hot Issues in Fire Engineering

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Response to Concerns on Installing Long-throw Sprinkler in Tall Atria

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It is nice to see that the design with long-throw sprinkler has attracted public attention. Long-throw sprinkler at height was proposed [1] to protect tall halls which are unlikely to store high amount of combustibles. That is why only water coverage tests were carried out.

However, in tall halls likely to store high combustible content, such as those atria putting in a tall Christmas tree. There is no in-depth research through full-scale burning experiments to demonstrate that the concept would work for conditions raised by Mr. K.P. Cheung.

Preliminary tests on long-throw sprinkler with a wood crib fire less than 0.5 MW reported years ago [1] indicated that heat released can be controlled only if the burning object is very small. However, mixing of smoke with air and steam should be watched [2] for any bigger fires over 0.5 MW, even when the ceiling height is low. That is because buoyancy of hot gases from big fires would induce much stronger turbulent airflow. Air entrainment towards the fire plume and sprinkler water spray would be entirely different from the flow pattern for a small fire. The long distance travelled by the water droplets in sprinkler water spray discharged in a tall hall can make the situation worse, giving much higher air entrainment rate. Therefore, the concerns raised by Mr. Cheung are strongly recommended to further explore for shopping malls with a tall atrium likely to store high combustible content, particularly those with a tall Christmas tree as raised recently [3].

Anyway, the design concept for tall atria storing high amount of combustibles must be justified with full-scale burning tests on big fires, not just demonstrating the phenomena by one or two small-scale field tests. Small-scale field tests in a hall lower than 5 m would not indicate anything abnormal. Burning combustibles to give a big fire in a tall hall will be very different. In-depth investigation is needed on justifying the proposed concerns by Mr. Cheung due to large air entertainment rate of water droplets travelling for a long distance, and buoyancy-induced air flow due to a big fire. Current design concept is only applicable in places unlikely to store high content of combustibles giving small heat release rates less than 0.5 MW.

References

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