

Further Measurements of Fire Spread through a Room with Polyurethane Foam Covered Walls

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ABSTRACT

Experiments in a mock-up of the platform area of The Station nightclub were conducted to characterize the fire growth and spread in the early stage of the fire. Approximately 20% of the nightclub was reconstructed in real scale with polyurethane foam covered walls, the drummer's alcove, the raised platform, carpeting, and wood paneling. The experimental facility and a preliminary analysis of the data were reported previously [1]. The complete data set is included in the final report on NIST's investigation into the incident [2]. Measurements of the temperatures, heat fluxes, and gas volume fractions allowed the performance of a computer fire model used in the investigation to be assessed. (A companion poster in these proceedings deals with the techniques used to model the complex problem of fire spread over the polyurethane covered plywood walls.) Two real-scale tests were conducted: one without automatic sprinklers, and one with automatic sprinklers. By designing the real-scale mockup experiments carefully, in terms of controlling factors such as fuel and ventilation, the experiments provided a means to determine the benefit of automatic sprinklers in a fire similar to what occurred in The Station, and to gain insight as to conditions in the nightclub during the early fire growth and spread, in particular the levels of CO and HCN since these cannot be predicted by the computer fire model. Between 61 s and 92 s after ignition of the polyurethane foam near the drummer's alcove, the conditions became untenable at head height everywhere within the test room, reaching temperatures approaching 500°C, heat fluxes in excess of 30 kW/m², oxygen volume fractions below 10%, and carbon monoxide and hydrogen cyanide levels greater than 1.0% and 0.075%, respectively. Similar measurements with the room equipped with an NFPA 13-compliant sprinkler system indicated that the room remained tenable for the duration of the test, although a remnant of the fire in the upper corners of the alcove did have to be extinguished manually at the termination of the test.

KEYWORDS: forensics, flame spread, fire growth, compartment fires, heat transfer, toxicity, heat release rate, fire investigation, sprinklers

REFERENCES

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