

RECOMMENDED READING: NIST TECHNICAL NOTE 1658

(Dormitory Room Fire Experiments-Non-Sprinklered vs. Sprinklered)

By Richard Schulte

Fire experiments which demonstrate the impact that sprinkler protection has on the environmental conditions which develop in a fire are rather common place these days, however, a series of fire experiments in a dormitory room documented in [NIST Technical Note 1658](#) is particularly well done. [NIST Technical Note 1658](#) is titled "*Impact of Sprinklers on the Fire Hazard in Dormitories: Sleeping Room Experiments*". This report is authored by Daniel Madrzykowski and William D. Walton of the Building and Fire Research Laboratory at the National Institute of Standards and Technology (NIST) and is dated January 2010.

The following is an excerpt from the Summary section(Section 4.4) which appears on page 78 of the report:

"The complete set of measurements from each of the five experiments was presented in Section 3. In the previous portions of this section comparisons have been provided to examine the impact of automatic sprinkler protection and the impact of keeping the door to the room of origin closed. In this summary section, Table 4.4-1 presents the smoke alarm and sprinkler activation times for comparison against the times to reach the untenability criteria in the dorm room and the corridor, given in Table 4.4-2.

In each of the experiments, the ionization smoke alarms installed in the dorm rooms activated within 12 s to 26 s after ignition. The average time between the first smoke alarm activation and the time to reach untenability in the dorm room for the three unsprinklered experiments (Experiment 1, 4 and 5) was 134 s. The last two experiments (Experiment 4 and 5), which were unsprinklered and had the dorm room door open, resulted in untenable conditions in the corridor as well as in the dorm room. The average time between the activation of smoke alarm in the center location in the corridor and the time to reach untenable conditions in the corridor was 356 s.

The untenable conditions in the corridor for Experiment 4 and 5, would represent the worst case for a building occupant, not located in the room of origin, who needed to use the corridor as a means of egress. In these experiments, the warning of the smoke alarms located in the corridor provided at least 5 minutes of available safe egress time.

Experiment 1 and 2 were conducted with the dorm room door closed. In both cases the corridor remained tenable throughout the duration of the experiments. In Experiment 1, which was unsprinklered, the closed door limited the availability of fresh oxygen to the fire, which resulted in the limitation of the amount of heat that could be released and eventually led to the self-extinguishment of the fire. While the thermal tenability limit was exceeded in the dorm room, the transmission of hazardous conditions from the fire to building occupants outside the room of origin were mitigated by the closed door.

Experiment 2 and 3 had active sprinkler systems installed. The time between the activations of the smoke alarm and the automatic sprinkler in the same room was approximately 90 s in both experiments. Experiment 3 had the dorm room door open to the corridor. As a result, the smoke alarms in the corridor also activated prior to the thermal activation of the sprinkler in the room. In both of the sprinklered experiments (Experiment 2 and 3), the tenability limits were not exceeded.”

The data presented in [Technical Note 1658](#) is superbly documented. This series of fire experiments clearly shows that sprinkler protection installed in a dormitory room mitigates the hazard of fire which could potentially occur in the room. The results presented can also be extended to hotel guest rooms, apartment buildings and single-family dwellings, as well as other light hazard occupancies, such as office spaces and classrooms in educational occupancies.

Based upon the results of these experiments, it can be concluded that sprinkler protection is not only capable of addressing the issue of fire, but also of smoke and toxic gases produced by fire, regardless of whether or not the door to the dormitory room is in the open or closed position.

[NIST Technical Note 1658](#) can be found at the following internet address:

<http://fire.nist.gov/bfrlpubs/fire10/PDF/f10001.pdf>

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