

# **U.S. EXPERIENCE WITH SPRINKLERS**

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## Abstract

Automatic sprinklers are highly effective elements of total system designs for fire protection in buildings. They save lives and property, producing large reductions in the number of deaths per thousand fires, in average direct property damage per fire, and especially in the likelihood of a fire with large loss of life or large property loss. In 2009, 4.6% of occupied homes (including multi-unit) had sprinklers, up from 3.9% in 2007, and 18.5% of occupied homes built in the previous four years had sprinklers. When sprinklers are present in the fire area, they operate in 91% of all reported non-confined structure fires large enough to activate sprinklers, excluding buildings under construction. When they operate, they are effective 96% of the time, resulting in a combined performance of operating effectively in 87% of reported non-confined fires where sprinklers were present in the fire area and fire was large enough to activate sprinklers. In homes (including multi-unit), wet-pipe sprinklers operated effectively 92% of the time. When wet-pipe sprinklers are present in homes that are not under construction and excluding cases of failure or ineffectiveness because of a lack of sprinklers in the fire area, the fire death rate per 1,000 reported structure fires is lower by 83%, and the rate of property damage per reported home structure fire is lower by 71%. When sprinklers fail to operate, the reason most often given (65% of failures) is shutoff of the system before fire began.

Keywords: fire sprinklers; fire statistics; automatic extinguishing systems; automatic suppression systems

## Acknowledgements

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## Executive Summary

Automatic sprinklers are highly effective and reliable elements of total system designs for fire protection in buildings. According to the 2009 American Housing Survey, in 2009, 4.6% of occupied homes (including multi-unit) had sprinklers, up from 3.9% in 2007, and 18.5% of occupied home built in the previous four years had sprinklers.

Of reported 2005-2009 structure fires, an estimated 9% showed sprinklers present.\* Sprinklers were reported as present in 57% of reported fires in health care properties. Manufacturing facilities (48%), hotels and motels (49%), prisons and jails (50%), and dormitories and barracks (51%), all had sprinklers reported in roughly half of reported structure fires. In every other property use, more than half of all reported fires were reported as sprinklers not present.

Sprinklers are still rare in most of the places where people are most exposed to fire, including educational properties (34% of fires), stores and offices (23%), public assembly properties (21%), and especially homes (6%), where most fire deaths occur. There is considerable potential for expanded use of sprinklers to reduce the loss of life and property to fire.

Sprinklers operated in 91% of all reported structure fires large enough to activate sprinklers, excluding buildings under construction and buildings without sprinklers in the fire area. When sprinklers operated, they were effective 96% of the time, resulting in a combined performance of operating effectively in 87% of all reported fires where sprinklers were present in the fire area and fire was large enough to activate them. The more widely used wet pipe sprinklers operated effectively 89% of the time, while dry pipe sprinklers operated effectively in 74% of cases.

With wet-pipe sprinklers the fire death rate per 1,000 reported home structure fires was lower by 83% and the rate of property damage per reported home structure fire was lower by 71%. For more on NFPA's home Fire sprinkler Initiative, go to <http://www.firesprinklerinitiative.org>

When sprinklers fail to operate, the reason most often given (65% of failures) was shutoff of the system before fire began, as may occur in the course of routine inspection or maintenance. Other leading reasons were manual intervention that defeated the system (16%), lack of maintenance (7%), and inappropriate system for the type of fire (5%). Only 7% of sprinkler failures were attributed to component damage.

When sprinklers operate but are ineffective, the reason usually had to do with an insufficiency of water applied to the fire, either because water did not reach the fire (43% of cases of ineffective performance) or because not enough water was released (28% of cases of ineffective performances). Other leading reasons were manual intervention that defeated the system (9%), system component damage (8%), lack of maintenance (6%), and inappropriate system for the type of fire (5%).

\* These estimates are projections based on the detailed information collected in Version 5.0 of the U.S. Fire Administration's National Fire Incident Reporting System (NFIRS 5.0) and the NFPA's annual fire department experience survey. These statistics exclude buildings under construction and cases of failure or ineffectiveness because of a lack of sprinklers in the fire area and after some recoding between failure and ineffectiveness based on reasons given. Because nearly all fires reported as confined fires are reported without sprinkler performance details or as fires too small to activate operating equipment, confined fires are not included in any analysis involving reliability or effectiveness of automatic extinguishing equipment. See Appendixes A and B for additional details of statistical methodology, including the distinction between confined and non-confined fires.

Sprinkler systems are carefully designed to activate early in a real fire but not to activate in a non-fire situation. Each sprinkler reacts only to the fire conditions in its area. Water release in a fire is generally much less than would occur if the fire department had to suppress the fire, because later action means more fire, which means more water is needed. Water release with no fire is rare compared to water release in response to a fire.

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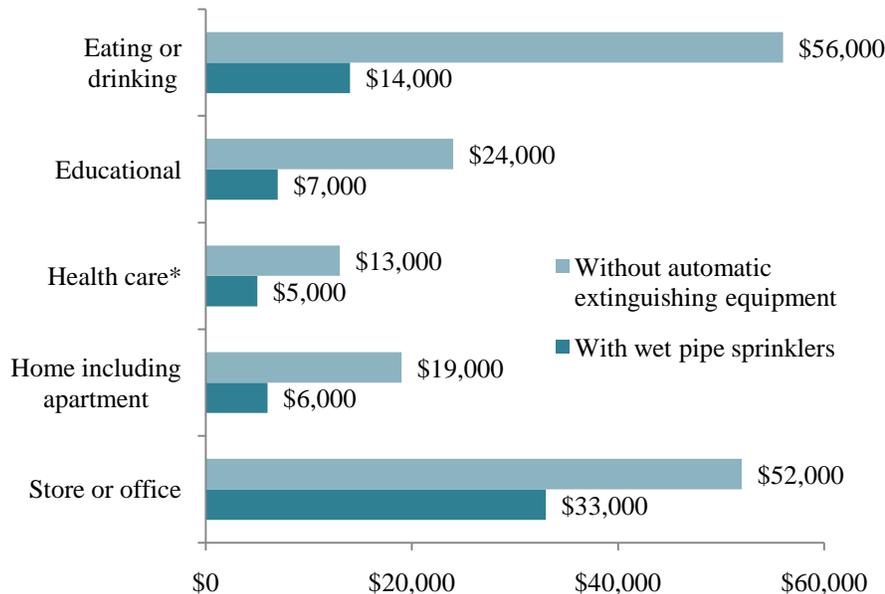
## U.S. Experience with Sprinklers

Sprinklers save lives and protect property from fires.

Compared to properties without automatic extinguishing equipment

- The death rate per fire in sprinklered homes is lower by 83%.
- Direct property damage per fire in sprinklered homes is lower by 71%.

**Damage per Fire With Wet Pipe Sprinklers versus Without Automatic Extinguishing Equipment, 2005-2009**



\*Health care refers to hospitals, nursing homes, clinics, doctor's offices, and mental retardation facilities.

Sprinklers are reliable and effective.

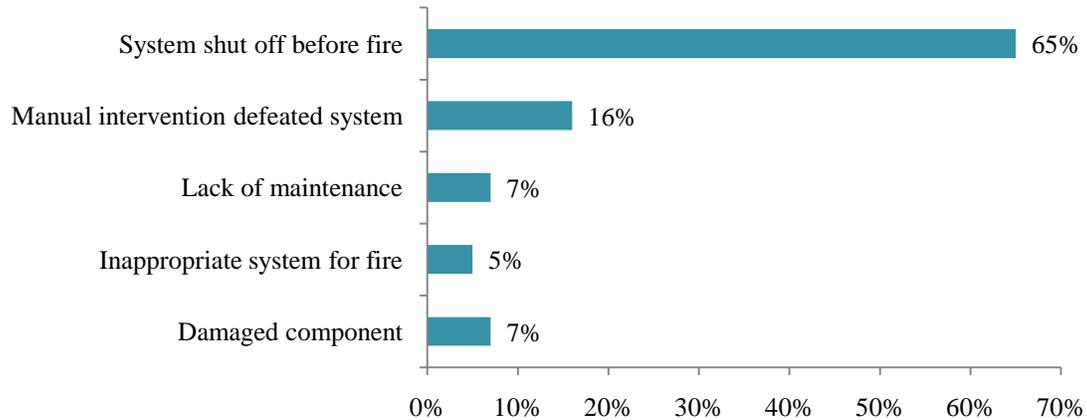
- In reported structure fires large enough to activate them, sprinklers operated in 91% of fires in sprinklered properties.
- Wet pipe sprinklers operated in 92% of these fires vs. 80% for dry pipe sprinklers.
- In reported structure fires large enough to activate them, sprinklers operated and were effective in 87% of fires in sprinklered properties.
- Wet pipe sprinklers operated and were effective in 89% of non-confined fires vs. 74% for dry pipe sprinklers.

NFPA's Fire Sprinkler Initiative: Bringing Safety Home seeks to encourage the use of home fire sprinklers and the adoption of fire sprinkler requirements for new construction. See [www.firesprinklerinitiative.org](http://www.firesprinklerinitiative.org).

Statistics are based on 2005-2009 U.S. reported fires excluding buildings under construction and properties with no sprinklers in fire area. Almost no reported confined fires are large enough to activate operating sprinklers, and so confined fires are excluded from analysis of reliability and effectiveness.

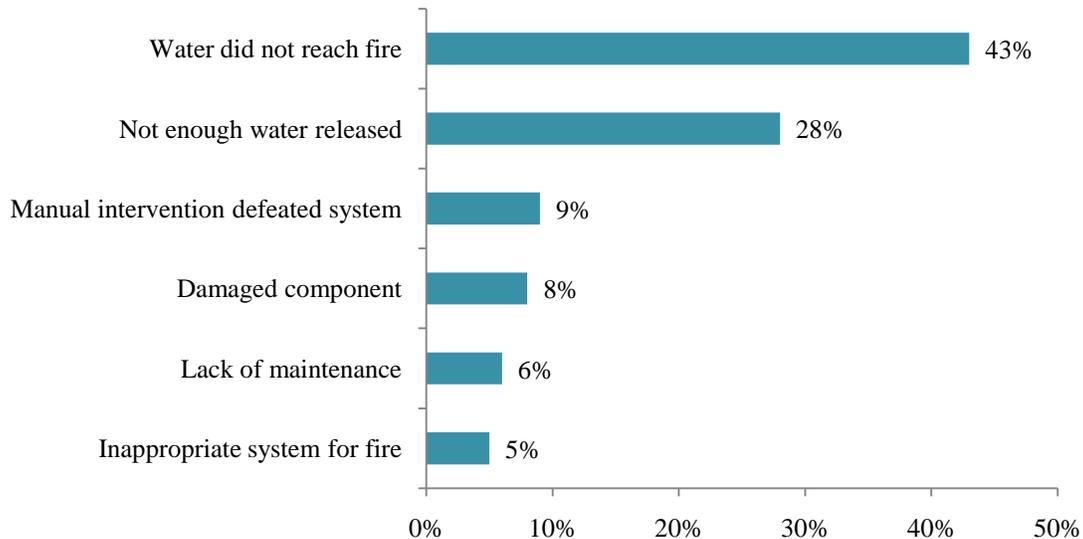
In 2005-2009 fires large enough to activate them, sprinklers operated in 91% of fires in sprinklered properties. The graph below is based on the other 9% in which sprinklers should have operated but did not.

### Reasons When Sprinklers Fail to Operate, 2005-2009



In 2005-2009 fires where sprinklers operated, they were effective in 96% of the cases. The graph below is based on the other 4% in which the sprinkler was ineffective.

### Reasons When Sprinklers Are Ineffective, 2005-2009



Usually only 1 or 2 sprinklers are required to control the fire.

- When wet pipe sprinklers operated, 88% of reported fires involved only 1 or 2 sprinklers.
- For dry pipe sprinklers, 72% involved only 1 or 2 sprinklers.

Statistics are based on 2005-2009 U.S. reported fires excluding buildings under construction and properties with no sprinklers in fire area. Almost no reported confined fires are large enough to activate operating sprinklers, and so confined fires are excluded from analysis of reliability and effectiveness.

# NFPA's Fire Safety Resources

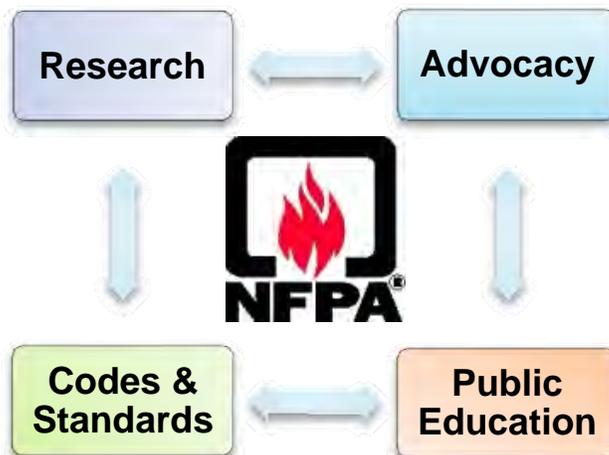
NFPA's wealth of fire-related research includes investigations of technically significant fire incidents, fire data analysis, and the Charles S. Morgan Technical Library, one of the most comprehensive fire literature collections in the world. In addition, NFPA's Fire Protection Research Foundation is a source of independent fire test data. Find out more at:

[www.nfpa.org/research](http://www.nfpa.org/research)

Properly installed and maintained smoke alarms are necessary to provide a warning of any fire to all occupants. You can find out more information about smoke alarms here: [NFPA Smoke Alarm Information](#)

Home fire sprinkler systems provide even greater protection. These systems respond quickly to reduce the heat, flames, and smoke from a fire until help arrives. More information about home fire sprinklers may be found at [www.firesprinklerinitiative.org](http://www.firesprinklerinitiative.org)

Simply put, smoke alarms and fire sprinklers save lives.



NFPA also develops, publishes, and disseminates more than 300 consensus codes and standards intended to minimize the possibility and effects of fire and other risks. Among these are:

[NFPA1: Fire Code](#):

[NFPA 101: Life Safety Code®](#):

[NFPA 13R: Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height](#):

[For consumers](#): NFPA has consumer safety information regarding causes, escape planning, fire & safety equipment, and many other topics.

[For Kids](#): Sparky.org has important information for kids delivered via fun games, activities, and cartoons.

[For public educators](#): Resources on fire safety education programs, educational messaging, grants & awards, and many other topics.