The Latest NFPA Statistics on Sprinkler Performance

By John R. Hall, Jr.

The automatic sprinkler system is a highly effective and reliable element of the total system design for fire protection in buildings. Based on fires reported to U.S. fire departments from 2002 through 2004, excluding cases of failure or ineffectiveness because of a lack of sprinklers in the fire area, sprinklers operate in 93 percent of all reported structure fires large enough to activate sprinklers. When they operate, they are effective 97 percent of the time, resulting in a combined performance reliability of 90 percent.

The combined performance reliability for the more widely used wet-pipe sprinklers is 91 percent, while the combined performance reliability for dry-pipe sprinklers is 83 percent. By comparison, the combined performance reliability for dry-chemical systems is only 49 percent, but it's 90 percent for carbon dioxide systems.

When sprinklers are present in structures that are not under construction, the fire death rate per 1,000 reported structure fires for most property uses is lower by at least 57 percent, and the rate of property damage per reported structure fire is lower by 34 to 68 percent. These figures exclude cases of failure or ineffectiveness because of a lack of sprinklers in the fire area. In 89 percent of reported fires in structures not under construction, flame damage is confined to the room of origin, compared to 57 percent when no automatic extinguishing system is present. These figures also exclude cases of failure or ineffectiveness because of a lack of sprinklers in the fire area.

In an estimated 64 percent of structure fires in health-care properties reported in 2004, automatic extinguishing systems were present, and 97 percent of the automatic extinguishing systems reported in health-care structure fires were sprinkler systems. Automatic extinguishing systems were also present in the majority of structure fires reported in manufacturing properties in 2004, with 92 percent of those systems being sprinkler systems.

The few surveys that have been done of sprinkler usage in general have found that the usage levels are much higher than the percentages of sprinkler presence in fires for the same properties. On that basis, it is likely that sprinklers are now common in hotels and motels and in department stores. Apparently, however, sprinklers are still rare in many of the places where people are most exposed to fire, including educational properties, public assembly properties, offices, most stores, and especially homes, where most fire deaths occur. There is considerable potential for expanded use of sprinklers to reduce the loss of life and property to fire.

When sprinklers fail to operate, the reason most often given is that the system was shut off before the fire began, as may occur in the course of routine inspection or maintenance. Other leading reasons are manual intervention that defeated the system, lack of maintenance, and

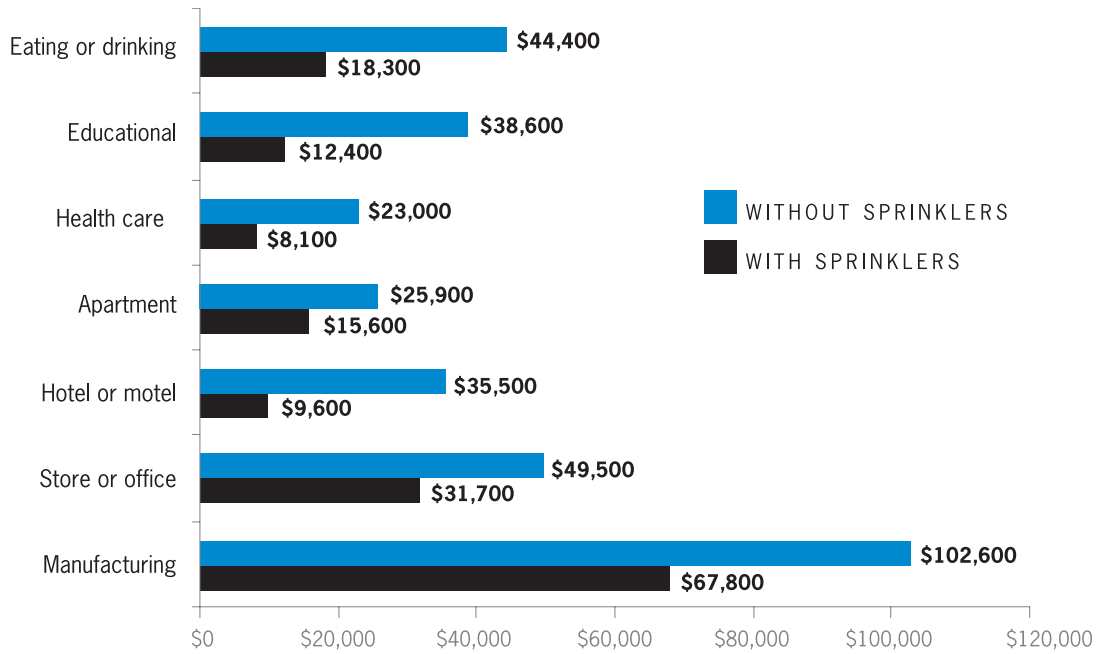
inappropriate system for the type of fire. Only 2 percent of sprinkler failures are attributed to component damage.

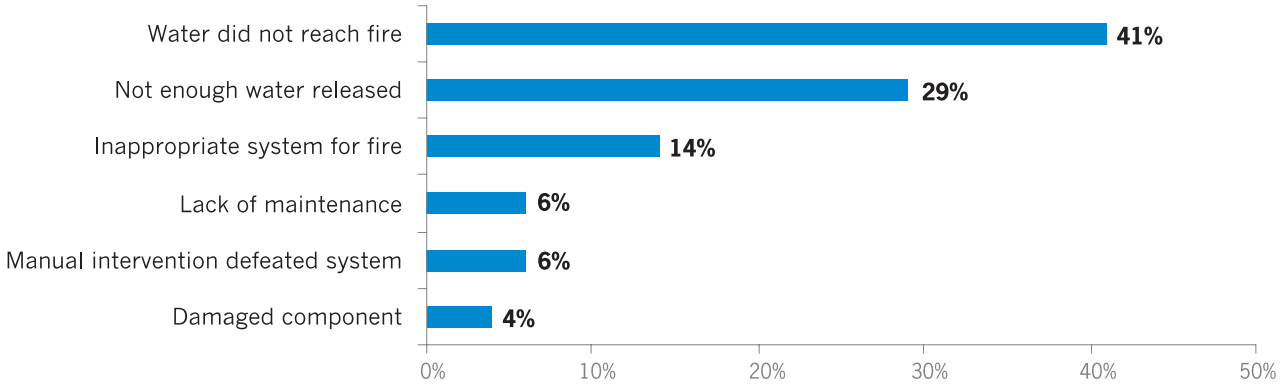
When sprinklers operate but are ineffective, the reason usually given is that too little water was applied to the fire, either because water did not reach the fire or because not enough water was released. Other leading reasons are an inappropriate system for the type of fire, lack of maintenance, and manual intervention that defeated the system. Only 4 percent of cases of sprinkler ineffectiveness are attributed to component damage.

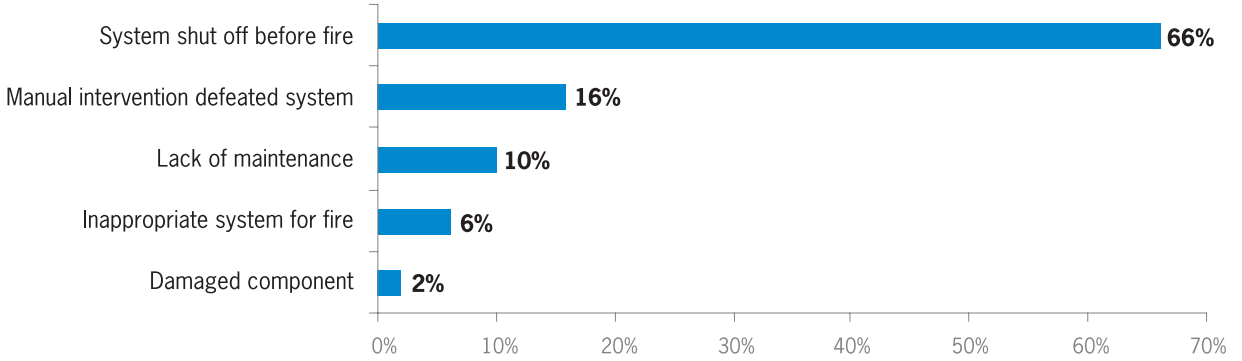
There are certain incidents in which even a complete sprinkler system will have limited impact. Among these are explosions and flash fires, which may overpower the system; fires that begin very close to a person or to unusually sensitive and expensive property where fatal injury or substantial property loss can occur before sprinklers can react; and fires that begin in unsprinklered areas or adjacent properties, which may grow to unmanageable size outside the range of the sprinkler system.

These situations can arise when sprinkler standards are based on design fires less severe than explosions or flash fires, as is normally the case. They may also arise when sprinkler objectives are defined in terms of a design fire area larger than the distance implied by a victim who is intimate with ignition or when sprinkler standards exclude certain potential areas of fire origin from their definition of complete coverage, which is typically, but not always, the case.

Sprinkler systems are so effective that it can be tempting to overstate just how effective they are. For example, some sprinkler proponents have focused too narrowly on the reliability of the components of the sprinkler system itself. If this were the only concern in sprinkler performance, there would be little reason for concern at all, but







human error is a relevant problem.

On the other hand, some people, concerned that sprinklers will be treated as a panacea to the detriment of other essential elements of fire protection, have treated human errors as intrinsic to sprinkler performance. In fact, all forms of active and passive fire protection tend to show more problems with human error than with intrinsic mechanical or electrical reliability.

It is important for all concerned parties to distinguish between human and mechanical problems because they require different strategies, and they should include both types of problems as concerns that must be addressed when deciding when and how to install, maintain, and rely on sprinkler systems. They should also strive to use performance analysis in assessing any other element of fire protection and remember that the different elements of fire protection support and reinforce one another and so must always be designed and considered as a system.

Because sprinkler systems are sophisticated enough to require competent fire protection engineering and because they function best in buildings with a complete, integrated system of fire protection, using proper procedures when installing and maintaining sprinkler systems is especially important.

This means careful adherence to the relevant standards: NFPA 13, *Installation of Sprinkler Systems*; NFPA 13D, *Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*; NFPA 13R, *Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height*; and NFPA 25, *Inspection, Testing and Maintenance of Water- Based Fire Protection Systems.*

Sprinkler systems are so demonstrably effective that they can make a major contribution to fire protection in any property. The 2006 editions of NFPA 101®, *Life Safety Code®*; NFPA 1, *Uniform Fire Code®*; and NFPA 5000®, *Building Construction and Safety Code®*, require sprinklers in all new one- and two-family dwellings, all nursing homes, and many nightclubs. This protection can be expected to increase in areas that adopt and follow these revised codes.

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