



**RESEARCH**



# US Experience with Sprinklers

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## KEY FINDINGS

### Sprinklers in Reported Structure Fires: All Occupancies

From 2017 to 2021, local fire departments responded to an estimated average of 52,948 structure fires per year (11 percent of the total structure fires) in which sprinklers were present. These fires caused an annual average of 36 civilian deaths (1 percent of all structure fire deaths); 1,002 civilian injuries (8 percent); and \$1.2 billion in direct property damage (10 percent).

Sprinklers reduce the impact of fires. Compared to reported fires in properties with no automatic extinguishing systems (AES), when sprinklers were present, the civilian fire death and injury rates per fire were 90 percent and 32 percent lower, respectively. In addition, the rate of firefighter injuries per fire was 35 percent lower.

Fire spread was confined to the object or room of origin in 94 percent of the reported structure fires in which sprinkler systems were present compared to 70 percent in properties with no AES.

Sprinklers have proven to be reliable in reported structure fires considered large enough to activate them. From 2017 to 2021, sprinklers operated in 92 percent of such fires and were effective at controlling the fire in 97 percent of the incidents. Overall, sprinkler systems operated and were effective in 89 percent of the fires considered large enough to activate them. The most common reason that sprinklers failed to operate was the systems being shut off at some point before the fire.

One sprinkler is usually enough to control a fire. In 77 percent of the structure fires where sprinklers operated, only one operated. In 96 percent, five or fewer operated. In 98 percent, 10 or fewer operated.

### Sprinklers in Reported Home Fires

Sprinklers were present in an estimated 23,675 (7 percent) of the reported home structure fires per year from 2017 to 2021. These fires resulted in an annual average of 22 civilian deaths (1 percent of all home fire deaths), 550 civilian injuries (5 percent), and \$249 million (3 percent) in direct property damage.

Sprinklers operated in 95 percent of the home structure fires in which systems were present and the fires were considered large enough to activate them. They were effective at controlling the fire in 98% of the fires in which they operated. Overall, sprinklers operated effectively in 93 percent of the fires large enough to trigger them.

In 85 percent of the home fires with operating sprinklers, only one sprinkler operated. In 99.2 percent of the fires, five or fewer operated.

Sprinklers save lives and reduce injuries and property loss. From 2017 to 2021, the civilian death and injury rates in home structure fires where sprinklers were present were 89 percent and 31 percent lower, respectively, than in home structure fires with no AES. In addition, the average property loss per home structure fire was 55 percent lower in reported home fires where sprinklers were present compared to fires in homes with no sprinkler systems and the firefighter injury rate was 48 percent lower.

In reported home structure fires where sprinklers were present, the fire was confined to the object or room of origin 96 percent of the time, compared to 72 percent in homes with no AES.

### Introduction

This report provides a statistical overview of sprinkler presence and performance in reported fires. This information is essential for understanding the prevalence, impact, reliability, and effectiveness of these systems and increasing their positive impact. Because most fire

deaths are caused by home fires, additional details are provided on sprinklers in fires in these properties.

Estimates were derived from the details collected by the US Fire Administration's (USFA's) [National Fire Incident Reporting System \(NFIRS\)](#) and NFPA's annual fire department experience survey. Unless otherwise specified, estimates in this report exclude fires in properties under construction. In addition, the casualty and loss estimates can be heavily influenced by the inclusion or exclusion of one unusually serious fire.

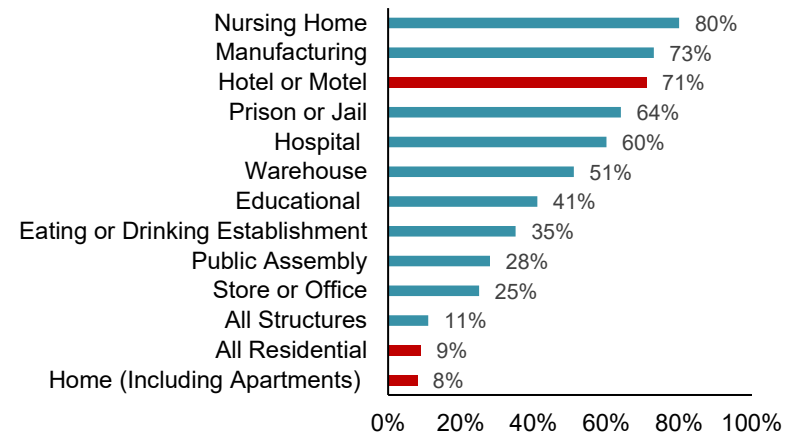
More detailed information is available in the [supporting tables](#).

### Sprinkler Presence and Type

Some type of sprinkler system was present in an estimated 52,948 (11 percent) of the reported structure fires during 2017–2021. Sprinkler presence varied widely by occupancy. Figure 1 shows the percentage of fires by occupancy in which any type of sprinkler system was present. Sprinklers were most likely to be found in institutional occupancies, such as nursing homes, hospitals, and prison or jails, as well as in industrial occupancies, such as manufacturing and warehouse properties.

Most structure fires and associated civilian fire deaths, injuries, and direct property damage occurred in residential properties, particularly homes. Only 9 percent of the reported residential fires occurred in properties with sprinklers. The outlier with regard to residential fires was hotel and motel properties, which were much more likely to have sprinklers compared to all other residential properties. Sprinklers were present in only 8 percent of fires in homes (including apartments).

**Figure 1. Presence of sprinklers in US structure fires by occupancy: 2017–2021 annual averages**



Some properties had both sprinkler and non-sprinkler AES. This was particularly common in commercial kitchens. For example, 60 percent of properties identified as eating and drinking establishments in which a structure fire occurred reported the presence of non-sprinkler AES. In such cases, the type of AES in the fire area is the only one recorded. This could result in underestimates of the presence of sprinklers in some occupancies.

Figure 2 shows that wet pipe systems were in use at almost nine out of every ten reported fires in which sprinklers were present.

**Figure 2. Types of sprinklers present at US structure fires: 2017–2021 annual averages**

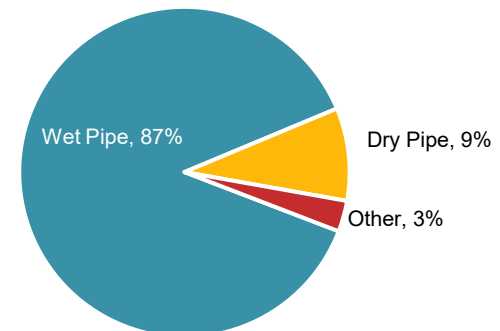
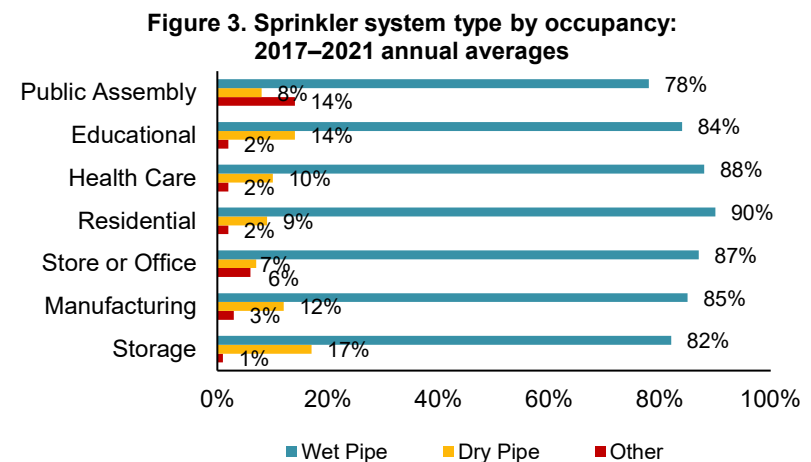


Table A. Summary of AES presence and type in reported structure fires: 2017–2021 annual averages

AES Presence and Type	Fires		Civilian Deaths		Civilian Injuries		Firefighter Injuries		Direct Property Damage (in Millions)	
<b>AES present</b>	<b>62,820</b>	<b>(13%)</b>	<b>37</b>	<b>(1%)</b>	<b>1,077</b>	<b>(8%)</b>	<b>497</b>	<b>(8%)</b>	<b>\$1,238</b>	<b>(11%)</b>
Sprinkler system present	52,948	(11%)	36	(1%)	1,002	(8%)	436	(7%)	\$1,179	(10%)
Wet pipe sprinkler system	46,316	(9%)	33	(1%)	894	(7%)	394	(7%)	\$1,076	(9%)
Dry pipe sprinkler system	4,909	(1%)	2	(0%)	91	(1%)	32	(1%)	\$91	(1%)
Other type of sprinkler system	1,722	(0%)	0	(0%)	17	(0%)	10	(0%)	\$12	(0%)
Non-sprinkler AES present	9,872	(2%)	1	(0%)	75	(1%)	61	(1%)	\$59	(1%)
<b>Partial AES system of any type present</b>	<b>2,253</b>	<b>(0%)</b>	<b>4</b>	<b>(0%)</b>	<b>62</b>	<b>(0%)</b>	<b>44</b>	<b>(1%)</b>	<b>\$106</b>	<b>(1%)</b>
<b>AES of any type not in fire area and did not operate</b>	<b>1,473</b>	<b>(0%)</b>	<b>2</b>	<b>(0%)</b>	<b>37</b>	<b>(0%)</b>	<b>25</b>	<b>(0%)</b>	<b>\$88</b>	<b>(1%)</b>
<b>No AES present</b>	<b>421,775</b>	<b>(86%)</b>	<b>2,840</b>	<b>(99%)</b>	<b>11,640</b>	<b>(91%)</b>	<b>5,381</b>	<b>(90%)</b>	<b>\$9,943</b>	<b>(87%)</b>
<b>Total</b>	<b>488,321</b>	<b>(100%)</b>	<b>2,883</b>	<b>(100%)</b>	<b>12,817</b>	<b>(100%)</b>	<b>5,947</b>	<b>(100%)</b>	<b>\$11,374.31</b>	<b>(100%)</b>
Rate per thousand fires with any sprinkler present:			0.68		18.92		8.23		22.27	
Rate per thousand fires with no AES present			6.73		27.60		12.76		23.57	
Percent reduction from no AES to any sprinkler system			90%		31%		35%		6%	

Figure 3 shows that wet pipe systems were the leading type of sprinkler in use overall. Dry pipe systems were more common in storage occupancies. Table 2 in the [supporting tables](#) shows that other types of sprinkler systems were seen most frequently in eating and drinking establishments and grocery or convenience stores. It is possible that some of these systems were miscodes of systems designed specifically for cooking equipment.



## Fires in Properties with Sprinklers vs. with No AES

Figure 4 shows that the death rate per 1,000 reported fires was 90 percent lower in properties with sprinklers than in properties with no AES. These rates are based strictly on the reported presence or absence of this equipment; whether the system operated or not was not considered. Civilian deaths in sprinklered properties are discussed in greater detail later in this report.

**Figure 4. Civilian death rates per 1,000 reported fires in properties with sprinklers vs. with no AES: 2017–2021 annual averages**

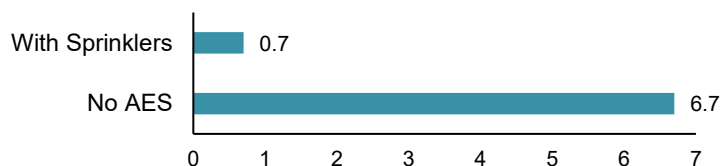


Figure 5 shows that the civilian injury rate per 1,000 reported fires was 31 percent lower in properties with sprinklers than in properties with no AES. Many of the injuries that occurred in sprinklered properties were caused by fires that were too small to activate the sprinklers. It is also possible that some of the injuries occurred while victims were attempting to fight a fire before the sprinklers activated.

**Figure 5. Civilian injury rates per 1,000 reported fires in properties with sprinklers vs. with no AES: 2017–2021 annual averages**

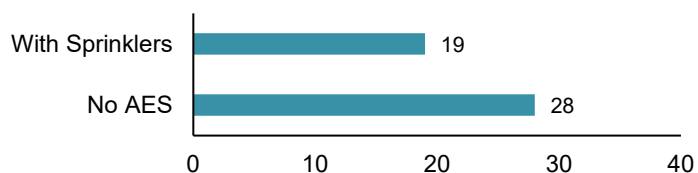
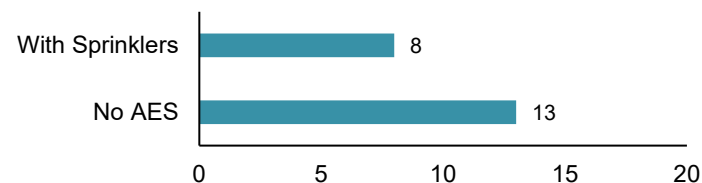


Figure 6 shows that the rate of firefighter injuries per 1,000 fires was 35 percent lower in structure fires where sprinklers were present compared to fires in properties without AES protection. Sprinklers can begin to control a fire when they activate, making the situation less dangerous for responding firefighters.

**Figure 6. Firefighter injury rates per 1,000 reported fires in properties with sprinklers vs. with no AES: 2017–2021 annual averages**



Reductions in the average dollar loss per fire when sprinklers were present varied greatly by occupancy. Table 4 in the [supporting tables](#) shows that compared to properties with no AES, the average overall loss was 6 percent lower in fires where sprinklers were present. However, the reduction in loss was 69 percent for store and office properties, 66 percent for public assembly properties, 60 percent for residential properties, and 59 percent for health care properties.

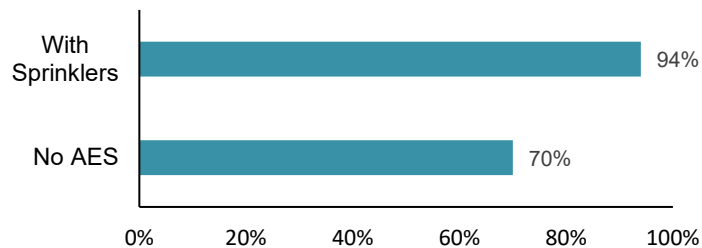
The average loss per fire was higher in sprinklered warehouses and manufacturing properties than in those with no AES. It should be kept in mind that these data cover all types of warehouses and manufacturing. A total loss in a small unsprinklered facility can be less than a limited loss in a large sprinklered facility where expensive machinery or commodities may be damaged due to smoke damage even when the fire is controlled by sprinklers. In rare cases when a sprinkler system fails to operate or operates ineffectively, the monetary loss can be exceedingly high. This scenario increases the average loss for the occupancy type. For example, the average loss in sprinklered manufacturing properties was inflated by a \$1.1 billion loss caused by a November 2019 Texas petrochemical plant

explosion and the resulting multi-day fire and additional explosions.<sup>1</sup> The plant's wet pipe sprinkler system did not operate.

According to FM Global automatic sprinklers provide the best protection against devastating fires in commercial occupancies. Comparisons of fire events from a commercial property insurer prove this year in, and year out. Their analysis shows that loss costs are typically about 8.5 times smaller at manufacturing facilities with adequate automatic sprinkler protection. This can often be a difference of millions of dollars and resuming operations within days, rather than months.

Sprinklers can also limit fire spread. Figure 7 shows a 24 percent increase in fires that were confined to the object or room of origin when sprinklers were present compared to fires with no AES.

**Figure 7. Percent of fires confined to the object or room of origin in properties with sprinklers vs. with no AES: 2017–2021 annual averages**



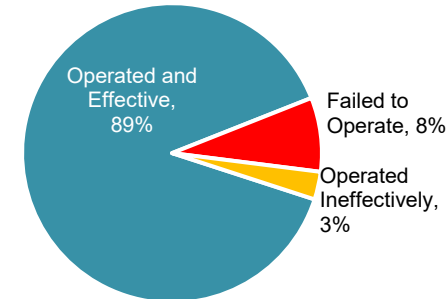
## Sprinkler Operation, Effectiveness, and Issues

From 2017 to 2021, sprinklers operated in 92 percent of the fires in which they were present, and the fire was considered large enough to activate them. They were effective at controlling the fire in 97 percent of fires in which they operated. In looking at these two estimates, it can be said that sprinklers operated effectively in 89 percent of the fires large enough to trigger them (see Figure 8.)

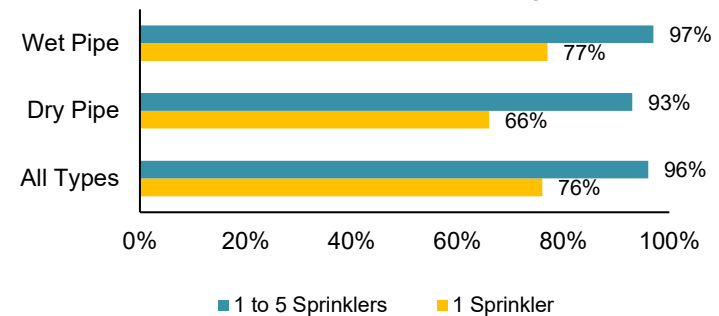
Details on sprinkler operation and effectiveness in different occupancies and for wet and dry pipe systems are provided in Table 6 of the [supporting tables](#).

Sprinkler systems are designed to operate only where fire is present. Only one sprinkler activated in more than three-quarters (76 percent) of the fires in which sprinklers of any type operated, and 77 percent of the fires with operating wet pipe sprinkler systems. Figure 9 shows that in 96 percent of the fires in which sprinklers operated, five or fewer were activated. This was true for 93 percent of the dry pipe sprinkler systems. See Table 7 in the [supporting tables](#) for additional details.

**Figure 8. Sprinkler operation and effectiveness: 2017–2021 annual averages**



**Figure 9. Percentage of fires in which one or one-to-five sprinklers operated by type of sprinkler system: 2017–2021 annual averages**



<sup>1</sup> S. Badger, "Large-Loss Fires and Explosions in the United States in 2019," *NFPA Journal*, November/December 2020. [nfpa.org/News-andResearch/Publications-and-media/NFPA-Journal/2020/November-December2020/Features/LL-Report](https://www.nfpa.org/News-andResearch/Publications-and-media/NFPA-Journal/2020/November-December2020/Features/LL-Report)



In 99 percent of the fires in which one sprinkler operated, it was effective. Figure 10 shows that sprinklers were somewhat less likely to be effective when more sprinklers operated.

**Figure 10. Percentage of fires in which sprinklers were effective by number that operated: 2017–2021 annual averages**

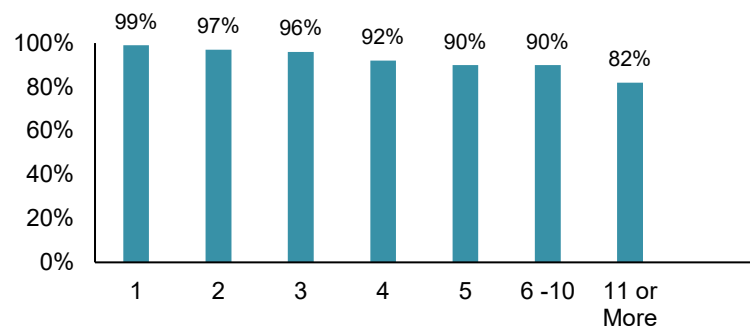


Figure 11 shows that the most common reason for sprinkler failure was because the system had been shut off.

**Figure 11. Reasons for sprinkler failure: 2017–2021 annual averages**

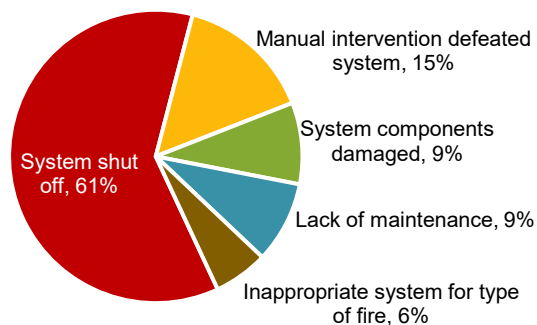
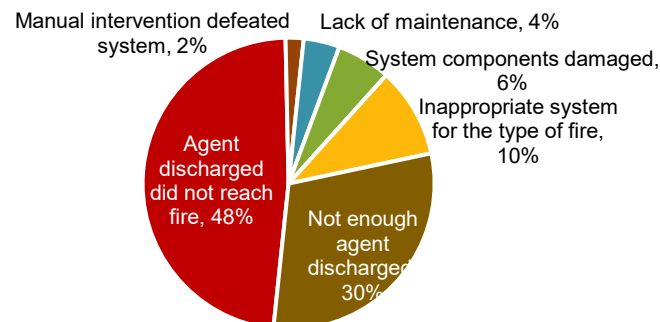


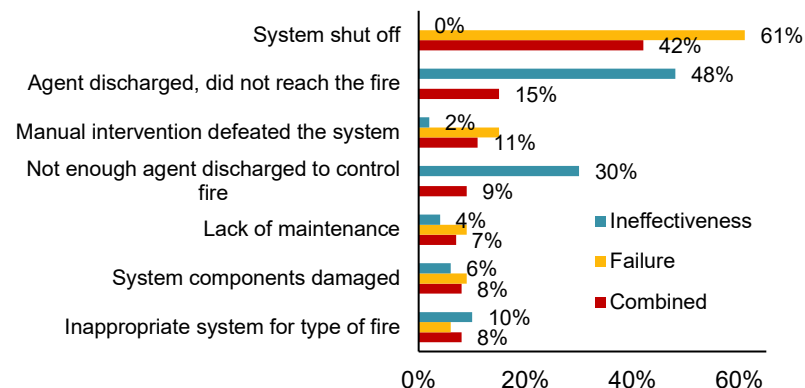
Figure 12 shows that when sprinkler systems operated ineffectively, the problem often involved getting water (or another agent) to the fire.

**Figure 12. Reasons for sprinkler ineffectiveness: 2017–2021 annual averages**



From 2017 to 2021, there was an estimated annual average of 771 fires where the sprinkler system failed to operate. In the same time period, in an annual estimate of 311 fires, the sprinkler system operated but was determined to be ineffective. Figure 13 shows the breakdown of each cause of failure or ineffectiveness individually and combined.

**Figure 13. Reasons for combined sprinkler failure and ineffectiveness: 2017–2021 annual averages**



## Civilian Deaths in Sprinklered Properties

While sprinklers were present in 11 percent of all the properties in which fires occurred from 2017 through 2021, only 1 percent of all fire deaths occurred in these properties. Fires in sprinklered properties killed an average of 36 people annually during this period. Fires in properties that were not under construction and had no automatic extinguishing system caused an estimated 2,840 deaths annually. Sprinkler systems operated in 27 of the estimated annual deaths that occurred in fires in sprinklered properties, 20 of which occurred when the sprinklers were reported to have operated effectively. See Figure 14.

**Figure 14. Civilian fire deaths by sprinkler performance: 2017–2021 annual averages**

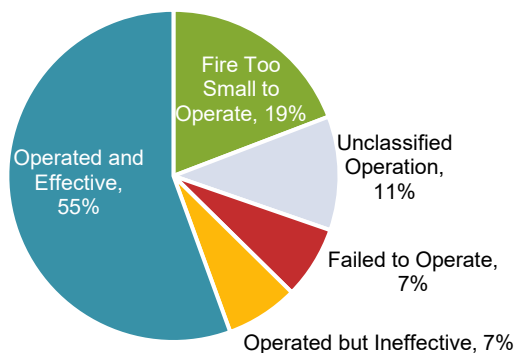
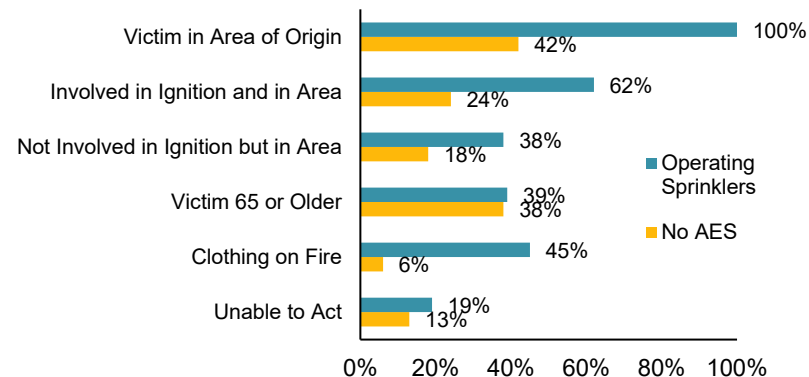


Figure 15 shows the characteristics of the deaths in sprinklered properties.

**Figure 15. Victim characteristics in fires with operating sprinklers vs. with no AES: 2017–2021 annual averages**



There are limits to even the best fire protection. When someone is directly involved in the ignition of a fire or their clothing is burning, they may be fatally injured before the sprinkler system operates. In addition, if someone is physically incapable of getting themselves to safety, even a fire controlled by sprinklers can still cause them harm.

Of the fire deaths in sprinklered properties, 76 percent resulted from fires that were confined to the object or room of origin. This was true for only 18 percent of the deaths that occurred in fires in which no AES was present. When present, data indicates that sprinklers keep the fire from spreading and threatening those in other areas. A fire that is confined to the room of origin is much less dangerous to those outside the room.



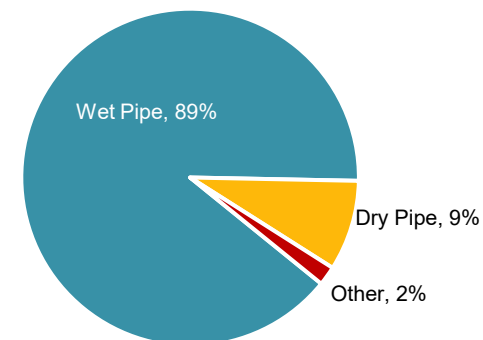
## Sprinklers in Home Fires

### Sprinkler Presence and Type

During 2017–2021, some type of sprinkler system was present in an estimated average of 23,675 (7 percent) of reported home structure fires per year. Properties under construction were excluded from these estimates. Table B summarizes information about automatic extinguishing systems (AES), including sprinklers, in all reported home structure fires except those in buildings under construction.

Figure 16 shows that wet pipe sprinkler systems were the most common systems present in reported home structure fires with sprinklers.

**Figure 16. Types of sprinkler systems present at home structure fires: 2017–2021 annual averages**



**Table B. Summary of AES presence and type in reported home structure fires: 2017–2021 annual averages**

AES Presence and Type	Fires		Civilian Deaths		Civilian Injuries		Firefighter Injuries		Direct Property Damage (in Millions)	
<b>AES present</b>	<b>24,830</b>	<b>(7%)</b>	<b>23</b>	<b>(1%)</b>	<b>575</b>	<b>(5%)</b>	<b>178</b>	<b>(4%)</b>	<b>\$252</b>	<b>(3%)</b>
Sprinkler system present	23,675	(7%)	22	(1%)	550	(5%)	176	(4%)	\$249	(3%)
Wet pipe sprinkler system	21,185	(6%)	21	(1%)	488	(4%)	164	(4%)	\$229	(3%)
Dry pipe sprinkler system	2,055	(1%)	2	(0%)	54	(0%)	11	(0%)	\$19	(0%)
Other type of sprinkler system	435	(0%)	0	(0%)	8	(0%)	1	(0%)	\$1	(0%)
Non-sprinkler AES	1,156	(0%)	1	(0%)	25	(0%)	2	(0%)	\$3	(0%)
<b>Partial AES system of any type present</b>	<b>839</b>	<b>(0%)</b>	<b>2</b>	<b>(0%)</b>	<b>42</b>	<b>(0%)</b>	<b>12</b>	<b>(0%)</b>	<b>\$24</b>	<b>(0%)</b>
<b>AES of any type not in fire area and did not operate</b>	<b>534</b>	<b>(0%)</b>	<b>1</b>	<b>(0%)</b>	<b>25</b>	<b>(0%)</b>	<b>9</b>	<b>(0%)</b>	<b>\$53</b>	<b>(1%)</b>
<b>No AES present</b>	<b>310,677</b>	<b>(92%)</b>	<b>2,578</b>	<b>(99%)</b>	<b>10,454</b>	<b>(94%)</b>	<b>4,456</b>	<b>(96%)</b>	<b>\$7,295</b>	<b>(96%)</b>
<b>Total</b>	<b>336,881</b>	<b>(100%)</b>	<b>2,605</b>	<b>(100%)</b>	<b>11,095</b>	<b>(100%)</b>	<b>4,655</b>	<b>(100%)</b>	<b>\$7,624.53</b>	<b>(100%)</b>
Rate per thousand fires with any sprinkler present			0.94		23.23		7.45		\$10.51	
Rate per thousand fires with no AES present			8.30		33.65		14.34		\$23.48	
Percent reduction from no AES to any sprinkler system			89%		31%		48%		55%	

## Fires in Homes with Sprinklers vs. with No AES

Figure 17 shows that the civilian death rate per 1,000 reported fires was 89 percent lower in homes with sprinklers than in homes with no AES during 2017–2021. These rates are based on the reported presence or absence of an AES; whether the system operated was not considered.

**Figure 17. Civilian death rates per 1,000 fires in homes with sprinklers vs. with no AES: 2017–2021 annual averages**

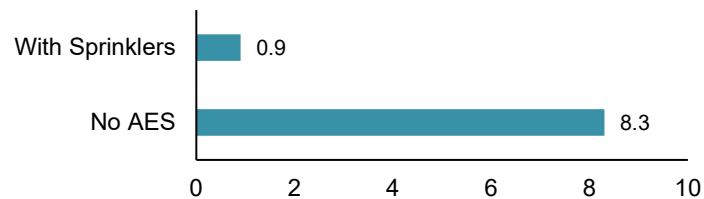


Figure 18 shows that the civilian injury rate per 1,000 reported fires was 31 percent lower in homes with sprinklers than in homes with no AES. In many cases, the injuries in sprinklered homes were caused by fires that were too small to activate the sprinkler system. In others, it's possible victims were injured while trying to fight the fire before the sprinklers operated.

**Figure 18. Civilian injury rates per 1,000 fires in homes with sprinklers vs. with no AES: 2017–2021 annual averages**

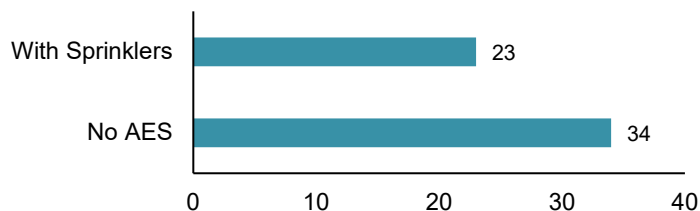
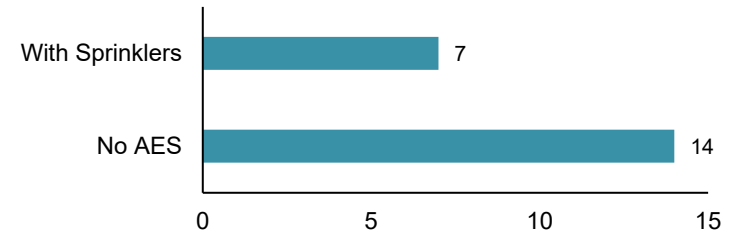


Figure 19 shows that the average firefighter injury rate per 1,000 reported home fires was 48 percent lower when sprinklers were present compared to fires in homes with no AES.

**Figure 19. Firefighter injury rates per 1,000 fires in homes with sprinklers vs. with no AES: 2017–2021 annual averages**



When sprinklers were present in reported home fires, the average property loss per fire was 55 percent lower than the average in homes with no AES. Figure 20 shows the rate of loss per 1,000 fires for homes with sprinklers versus homes with no AES. See also Table B.

**Figure 20. Rate of loss (in millions) per 1,000 fires in homes with sprinklers vs. with no AES: 2017–2021 annual averages**

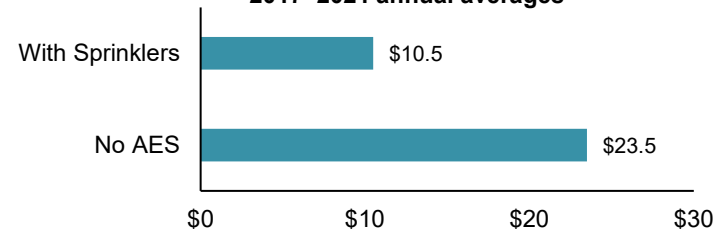
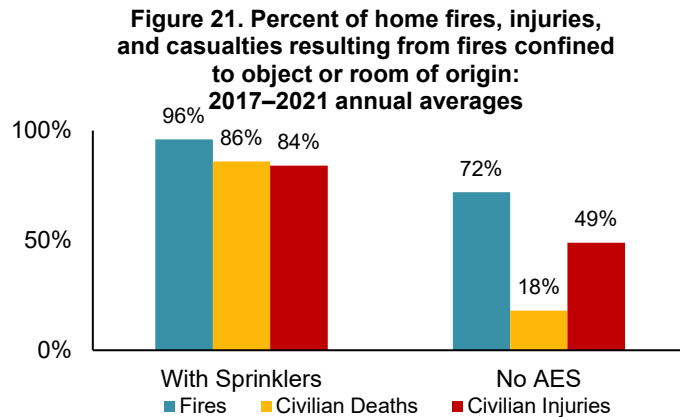


Figure 21 shows that when sprinklers were present, almost all of the home structure fires were confined to the object or room of origin. Most of the civilian deaths and injuries resulting from fires in homes with sprinklers were caused by these fires.

In home fires that lacked AES, 72 percent of the fires were confined to the object or room of origin. Less than a fifth of the deaths and less than half of the injuries in home fires with no AES present resulted from such fires.



## Sprinkler Operation, Effectiveness, and Issues in Home Fires

Figure 22 shows that sprinklers operated in most of the home fires in which sprinklers were present and the fires were considered large enough to activate them. They effectively controlled the fire in 98 percent of the time.

**Figure 22. Sprinkler operation and effectiveness in home fires: 2017–2021 annual averages**

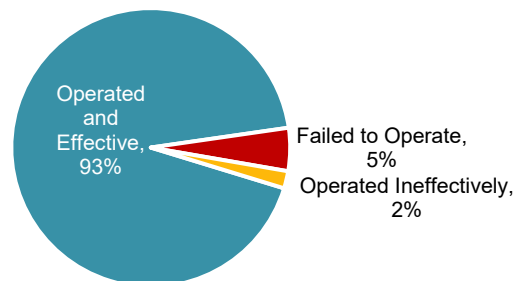
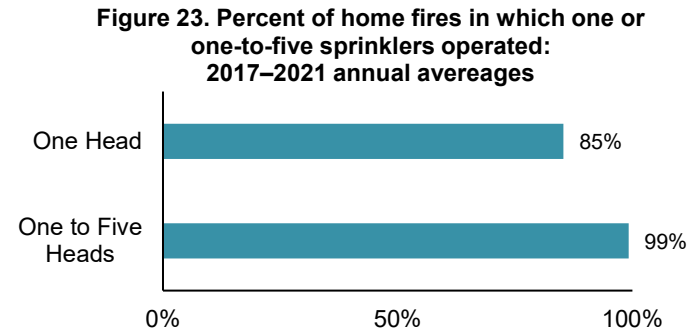


Figure 23 shows that in nearly all the home fires in which sprinklers operated, five or fewer individual sprinklers operated.

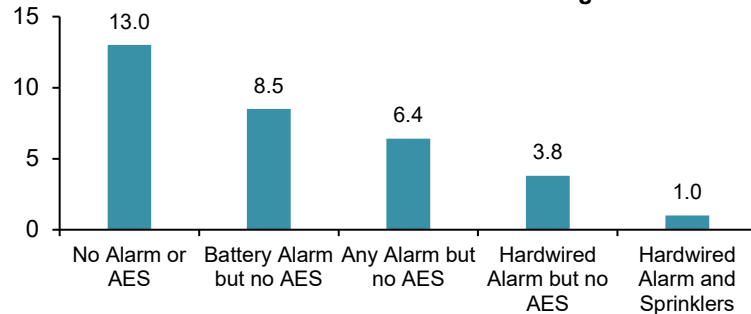


## Impact of Smoke Alarm and Sprinkler Presence on Death Rates per 1,000 Home Fires

The lowest home fire death rate per 1,000 reported fires was found in homes with sprinkler systems and hardwired smoke alarms. Figure 24 shows that compared to reported home fires in which no smoke alarms or AES were present (*including* properties under construction), the death rate per 1,000 fires was:

- 34 percent lower when battery-powered smoke alarms were present, but AES protection was not
- 51 percent lower when smoke alarms with any power source were present but AES protection was not
- 71 percent lower when hardwired smoke alarms were present but AES protection was not
- 92 percent lower when sprinklers and hardwired smoke alarms were present

**Figure 24. Average fire death rate per 1,000 reported home structure fires by presence of smoke alarms and AES: 2017–2021 annual averages**



Note that these rates are based on the *presence* of various types of fire protection; operation was not considered. Minor fires in homes with monitored smoke alarms are more likely to result in a fire department response than comparable fires in homes with unmonitored smoke alarms. Thus, they are more likely to be reported. Smoke alarms in monitored systems are generally hardwired.

## Methodology

The statistics in this analysis are estimates derived from the US Fire Administration’s (USFA’s) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association’s (NFPA) annual survey of US fire departments. Fires reported to federal, or state fire departments or industrial fire brigades are not included in these estimates. Unless otherwise specified, properties under construction were excluded from the analysis.

The NFPA fire department experience survey provides estimates of the bigger picture. NFIRS is a voluntary system through which

participating fire departments report detailed factors about the fires to which they respond.

To compensate for fires reported to local fire departments but not captured in NFIRS, scaling ratios are calculated and then applied to the NFRIS database using the formula below:

NFPA’s fire experience survey projections

NFIRS totals

NFPA also allocated unknown data proportionally to compensate for fires for which information was undetermined or not reported.

Fires in which partial sprinkler systems were present and fires in which sprinklers were present but failed to operate because they were not in the fire area were excluded from the estimates of presence and operation. Fires with one of the six NFIRS confined fire incident types were included in estimates of sprinkler presence, fire spread, and sprinklers operating, but not of operation or effectiveness in general.

Confined structure fires in NFIRS include confined cooking fires, confined chimney or flue fires, confined trash fires, confined fuel burner or boiler fires, confined commercial compactor fires, and confined incinerator fires (NFRIS incident types 113–118). Losses are generally minimal in these fires, which, by definition, are assumed to have been limited to the object of origin. Although detailed data about detection is not required for these fires, it is sometimes available.

The raw NFIRS data for 2017–2021, excluding properties under construction, contained a total of 7,661 confined structure fires (1 percent of total confined fires) in which some type of AES was present and 33,654 confined structure fires (5 percent of total confined fires) in which none was present. AES presence was

undetermined or left blank for 93 percent of the confined structure fires. A total of 3,953 of the reported confined fires with AES present indicated that wet pipe, dry pipe, or other sprinklers were present. The AES type was undetermined or not reported in 2,799 of the confined fires with AES present.

Sprinkler operation was reported in a total of 89 percent (3,522) of the confined fires in which sprinklers were present. Sprinkler operation for confined fires was used to calculate the number of sprinklers that operated but not for overall estimates of operation or effectiveness.

Non-confined structure fires are identified by NFIRS incident type 110–123, excluding incident types 113–118. The raw NFIRS data for 2017–2021 contained a total of 51,883 non-confined structure fires (7 percent of total non-confined fires) in which some type of AES was present and 641,040 non-confined structure fires (80 percent of total non-confined fires) in which none was present. Non-confined structure fires where some type of AES was present were associated with a total of 99 civilian deaths; 2,010 civilian injuries; and \$4.1 billion in direct property damage. AES presence was known for 87 percent of the non-confined fires, 91 percent of the deaths, 95 percent of the injuries, and 90 percent of the direct property damage. The AES type was known in 64 percent of the non-confined fires, 80 percent of the deaths, 80 percent of the injuries, and 81 percent of the associated property loss when AES was present.

When sprinklers were present in non-confined structure fires, sprinkler operation was known for a five-year raw total of 30,008 fires, which resulted in 76 deaths; 1,505 injuries; and \$3.2 billion in direct property damage. When present, sprinkler operation was known for 86 percent of the non-confined fires, 70 percent of the deaths, 86 percent of the injuries, and 83 percent of the direct

property damage. The NFIRS code “Operation of AES, other” was considered an unknown value.

When AES was coded as present but failed to operate, and the reason given was “Fire not in the area protected,” NFPA recoded the AES presence to “Not in fire area; did not operate.” These incidents and incidents coded to indicate the presence of partial systems were excluded from further analysis. Property damage has not been adjusted for inflation.

For more information on the methodology used for this report see, *How NFPA’s National Estimates Are Calculated for Home Structure Fires*.

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