Key Findings

- Local fire departments in the United States responded to an estimated average of 3,320 fires in school properties from preschool through grade twelve in 2013–2017.
- The fires in these school properties caused an estimated average of one civilian death, 42 civilian injuries, and $42 million in direct property damage a year.
- School property fires accounted for 1 percent of all US structure fires during this period and less than 1 percent of the accompanying civilian fatalities, injuries, and direct property damage.
- Nearly three in five school fires were small fire incidents identified as “confined fires,” meaning they were confined to the cooking equipment, chimneys, fireplaces, or boilers or trash in which they ignited.
- Two in five school fires were intentionally set. Fires with an intentional cause were more prevalent in high school and middle schools (47% of total) than in elementary schools (37%).
- Almost one-third of school fires were caused by cooking equipment and 10 percent by heating equipment.

High School and Middle School Fires

- In high school and middle school fires, nearly half of property damage was caused by a small share of fires occurring between midnight and 4 a.m., when buildings were unlikely to be occupied.
- Fires in high schools and middle schools were much more likely to originate in a lavatory or locker room than any other area. Fires originating in heating equipment rooms were rare events, but accounted for the greatest share of direct property damage.

Elementary School Fires

- Elementary school fires most often began with the ignition of trash or cooking materials.
- Several leading factors contributing to the ignition of elementary school fires had behavioral implications, including playing with a heat source, a misuse of a material or product, unattended equipment, and abandoned or discarded material or product.
- Electrical failures or malfunctions and mechanical failures or malfunctions also contributed to a substantial share of fires and potentially suggest gaps in maintenance and repair of school equipment or infrastructure.
- Lighters and matches together provided the heat source in almost three in 10 elementary school fires.
Part 1. Structure Fires in Schools

This report presents data on structure fires in school properties for the 5-year period from 2013 through 2017. School properties include high school and middle schools, elementary schools (including kindergarten), preschools, and unclassified non-adult schools. Fires in vehicles or non-structure fires on school grounds are not included in this report.

US fire departments responded to an estimated 3,320 structure fires in schools each year in 2013 to 2017. These fires resulted in averages of one civilian death, 42 civilian injuries, and $42 million in direct property damage a year. As indicated in Table 2 in the accompanying tables for this report, the fires in school properties represented 1 percent of all structure fires in the United States during this period and less than 1 percent of civilian deaths, injuries, and direct property damage. Due to low numbers, civilian deaths are not included in the analysis in this report.

Most school fires occurred in either high and middle schools or in elementary schools, as shown in Figure 1. Unclassified non-adult schools and preschools accounted for the remaining school fires and comparatively small shares of civilian injuries and direct property damage. School fire civilian injuries were concentrated in high school and middle school fires, and fires in high schools and middle schools also accounted for approximately half of direct property damage in school fires.

In 2013–2017, nearly three in five school fires were small fire incidents identified as “confined fires.” These fires were confined to the cooking equipment, chimneys, fireplaces, or boilers or trash in which they ignited. Accordingly, the 41 percent of school fires classified as “non-confined fires” accounted for the vast majority of civilian injuries and direct property damage.

![Figure 1. Structure Fires and Losses by School Type 2013–2017 Annual Averages](image)

School Fires by Year

As shown in Figure 2, the number of structure fires occurring annually in schools follows a distinct downward trend since 2003, with the sharpest decrease between 2004 and 2010. The annual number of school fires has generally been stable since 2012, although the 2,990 fires in 2016 represents the low point for this period. Injuries and direct property damage have shown substantial year-to-year fluctuation, as indicated in Table 1 of the accompanying tables for this report.
Figure 2. Structure Fires in School Properties by Year, 2003–2017

Figure 3 shows the leading causes of fires in school properties. The data in this table come from several National Fire Incident Reporting System (NFIRS) data elements. Double counting is possible, particularly for playing with heat source and intentional. For more information, see Methodology and Definitions Used in Leading Causes of Structure Fires Tables.

Fires that were intentionally set were the leading cause of school fires, accounting for almost two of five fires, as shown in Figure 3. These fires also caused nearly one-third of property damage in school fires. Fires caused by cooking equipment were the second leading cause of school fires, but resulted in little property damage. The ongoing presence of kitchen and other staff in schools is likely to be a factor that differentiates cooking-related fires in schools from those in homes, where cooking fires may be unattended and more likely to cause damage. Fires that involved playing with a heat source were responsible for another one-quarter of fires and were associated with the greatest share of injuries, 29 percent. Heating equipment accounted for 12 percent of fires.

Figure 3. Structure Fires in School Properties by Leading Cause 2003–2017 Annual Averages
Timing of School Fires

School fires are most likely to occur during the daytime hours when facilities are at their peak occupancy, as shown in Figure 4. Two-thirds of school fires occurred between 8 a.m. and 4 p.m., but these fires accounted for just one-quarter of direct property damage, indicating that many of the fires were detected and extinguished relatively quickly. A comparatively small share of fires occurred in the 12-hour period between 8 p.m. and 8 a.m., as shown in Figure 3. Significantly, 4 percent of fires occurring between midnight and 4 a.m. accounted for nearly one-third of direct property damage. Sprinklers can control a fire until the fire department arrives. A report on the U.S. Experience with Sprinklers by Marty Ahrens found that sprinklers were present in only 39 percent of the reported fires in educational properties. A recent report from the UK found that sprinkler systems were not present in any of 46 school fires attended by London firefighters in 2019.

Area of Fire Origin

School fires most often originated in a lavatory or locker room. This is consistent with the intentional causes of many school fires and suggests that they frequently involve student fire play. The majority of these fires were small confined fires and caused little property damage. However, they were likely to result in injuries, underscoring the importance of education and intervention strategies to prevent intentional fire setting.

A kitchen or cooking area was the second leading area of origin for school fires, with confined fires again predominant and little direct property damage. Fires in small assembly areas and unclassified outside areas each accounted for 5 percent of fires, and the remaining fires were distributed among a variety of areas of origin. Just 2 percent of fires originated on an exterior roof surface, but these accounted for 10 percent of direct property damage. Fires originating in a heating equipment room, also 2 percent of the total, caused 8 percent of direct property damage.
Human behavior was involved in the two leading factors contributing to the ignition of school fires—playing with fire and unclassified misuse of materials or products. Electrical failures or malfunctions and mechanical failures or malfunctions were other leading factors, with the latter accounting for the largest share of direct property damage. Human behavior also appeared to be involved in a number of other leading factors, including fires involving abandoned or discarded materials or products, heat sources being too close to combustible materials, unattended equipment, failure to clean, equipment not properly operated, and equipment accidentally turned on or not turned off, suggesting that many school fires could be prevented with enhanced training and education efforts.

**Factors Contributing to Ignition**

Reflecting the predominance of intentional and cooking causes in school fires, the items most often first ignited were trash, cooking materials, and a magazine, newspaper, or writing paper. Other leading items included electrical wire or cable insulation, rolled or wound material, flammable or combustible liquids or gases, and appliance housing or casing.
Part 2: Structure Fires in High Schools and Middle Schools

Because high schools and middle schools include distinctly different student populations from elementary schools, it is useful to analyze key data elements of these two school groups separately. Note that high schools and middle schools represent a single code in the NFIRS and that data cannot be further disaggregated between the two.

Leading Causes of Structure Fires in High Schools and Middle Schools

Fires with an intentional cause were the leading cause of fires in high schools and middle schools, accounting for nearly half of all fires. Fires caused by cooking equipment and fires caused by playing with a heat source were additional leading causes, followed by fires caused by heating equipment and smoking materials. It is worth noting that the prevalence of intentional fires in schools is not a problem unique to the United States. For instance, a report from Sweden in 2012 found that 40 percent of fires in Swedish school buildings were caused by arson.

Nearly half of fires in high schools and middle schools had an intentional cause of ignition, indicating that middle and high schools comprise the largest share of the school intentional fire problem (Figure 7). Fires having an unintentional cause accounted for the largest share of direct property damage, while fires caused by a failure of equipment or a heat source were more likely to result in injuries than other causes.

Timing of Fires in High Schools and Middle Schools

The vast majority of fires in high schools and middle schools occurred during peak occupancy hours between 8 a.m. and 4 p.m., and these fires also accounted for most of the injuries. Almost half of property damage was caused by a small share of fires occurring between midnight and 4 a.m., when buildings were unlikely to be occupied.
Area of Origin
Fires in high schools and middle schools were substantially more likely to originate in a lavatory or locker room than any other area, with a share of fires three times greater than fires originating in a kitchen or cooking area. Fires originating in heating equipment rooms accounted for the greatest share of direct property damage, while representing a small share of the total.

Item First Ignited
The leading items first ignited in high school and middle school fires were rubbish, trash, or waste, magazines, newspapers, or writing paper, and cooking materials. These fires are likely to relate to the prevalence of fires with an intentional cause or that involve cooking. Damage from these fires was generally low, collectively accounting for just 2 percent of civilian injuries and 7 percent of direct property damage. Fires in which flammable...
or combustible liquids or gases, piping and filter were first ignited—just 4 percent of the total—caused 29 percent of the property losses.

**Factors Contributing to Ignition**

Factors relating to human behavior were the two leading causes of middle and high school fires: playing with heat source contributing to the ignition of one-fifth of fires and some form of misuse of a material or product contributing to the ignition of another 16 percent of fires.

**Heat Source**

As shown in Figure 10, one-third of fires in high schools and middle schools were started by a lighter or a match. However, powered equipment and operating equipment provided the heat for almost three in 10 fires and produced the most direct property damage. Arcing also served as a leading heat source in high school and middle school fires, underscoring the need for proper maintenance of electrical equipment and use of power cords and caution with electrical hazards in schools.
Part 3: Structure Fires in Elementary Schools

Fires in elementary schools are less likely to be intentionally ignited than fires in middle and high schools. Approximately two in five elementary school fires had an unintentional cause of ignition, and these fires were responsible for two-thirds of elementary school fire injuries (Figure 11). Even at elementary schools, however, many fires were intentionally set, underscoring the importance of early education and controlling access to sources of ignition, such as matches and lighters. These fires also accounted for the highest share of injuries. Other leading causes of fires in elementary schools included cooking equipment, playing with heat source, and to a lesser extent, heating equipment.

Timing of Fires in Elementary Schools

The peak period for fires in elementary schools was the 8-hour period between 8 a.m. and 4 p.m., but the share of fires during these school hours was lower than that in high schools. The largest share of direct property damage was associated with fires occurring between 8 p.m. and midnight, which represented just 10 percent of the total.

Area of Fire Origin

Fires in elementary schools were most likely to start in the lavatory or locker room or kitchen or cooking area, though the share of lavatory or locker room fires is substantially lower than high schools, reflecting the lower prevalence of intentional fires at the elementary school level. Fires starting on an exterior roof surface caused a disproportionate share of direct property damage.
**Item First Ignited**

Elementary school fires were most often ignited by trash or by cooking materials. Fires ignited by cooking materials were primarily minor fires and did not result in property damage. The ongoing presence of kitchen staff in schools is likely to be a factor that differentiates cooking-related fires in schools from those in homes where cooking fires may be unattended and are more likely to cause damage.

![Figure 13. Structure Fires in Elementary Schools by Item First Ignited, 2013–2017 Annual Averages](image)

**Factor Contributing to Ignition**

Several leading factors contributing to the ignition of elementary school fires had behavioral implications, including playing with a heat source, a misuse of a material or product, unattended equipment, and abandoned or discarded material or product. Electrical failures or malfunctions and mechanical failures or malfunctions also contributed to a substantial share of fires and potentially suggest gaps in maintenance and repair of school equipment or infrastructure.

**Heat Source**

Lighters and matches together provided the heat source in almost three in 10 elementary school fires. This is consistent with intentional fires and fires involving fire play (Figure 14). Other leading heat sources of elementary school fires involved equipment or electrical sources, including heat from powered equipment or operating equipment and electrical arcing.

![Figure 14. Structure Fires in Elementary Schools, by Heat Source 2013–2017 Annual Averages](image)
Additional Information

See *Structure Fires in Schools: Supporting Tables* by Richard Campbell, September 2019, for more detailed information about the material presented in this report.

Acknowledgments

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