**Key Findings**

US fire departments responded to an estimated average of 3,396 structure fires involving hot work each year from 2017 to 2021. These fires caused an estimated yearly average of 19 civilian deaths, 120 civilian injuries, and $292 million in direct property damage.

Of these fires involving hot work, 46 percent occurred in or on homes, including one- or two-family homes and apartments and other multifamily homes, while 44 percent occurred in or on non-home properties.

Welding torches were the most common type of equipment involved in these fires.

In homes, welding torches were involved in 38 percent of the fires, 43 percent of the civilian deaths, 44 percent of the civilian injuries, and 45 percent of the direct property damage.

In non-home properties, welding torches were involved in 52 percent of the fires, 47 percent of the civilian deaths, 33 percent of the civilian injuries, and 32 percent of the direct property damage.

While soldering equipment was involved in only 9 percent of the non-home fires, it was involved in nearly four times the share of home fires (34 percent).

Fires involving hot work equipment mostly occurred in occupied and operating buildings. When these fires occurred, 81 percent of the homes and 75 percent of the non-homes were occupied.

Wall assemblies or concealed spaces (16 percent) and lavatories and bathrooms (15 percent) were the most common areas of origin in home fires. In non-homes, the most common areas of origin were exterior roof surfaces (12 percent) and garages (8 percent).

In homes, the item first ignited was most commonly a structural component or finish (64 percent). In non-homes, the item first ignited was most commonly an organic material (32 percent).

Items in the liquids, piping, or filters category were the items first ignited in 13 percent of the fires in non-home properties. These fires accounted for all the civilian deaths that occurred during 2017–2021 in the non-home properties and 25 percent of the non-home fire civilian injuries.

For both homes and non-homes, the leading factors contributing to ignition were heat sources too close to combustibles and cutting or welding too close to combustible material.

**Introduction**

For this report, NFPA analyzed data from fires involving a variety of codes related to shop tools and industrial equipment. Those codes include the following:

1) Power nail gun, stud driver, or stapler
2) Welding torch
3) Cutting torch
4) Burners
5) Soldering equipment
6) Tarpot or tar kettle.

During the five-year period from 2017 to 2021, local fire departments responded to an estimated annual average of 3,396 structure fires involving equipment associated with hot work. These fires resulted in an estimated 19 civilian deaths, 120 civilian injuries, and $292 million in direct property damage.

These estimates were derived from detailed information collected by the US Fire Administration’s National Fire Incident Reporting System (NFIRS) and summary information from NFPA’s annual fire experience survey.

**Hot work fires by occupancy**

Figure 1 shows that slightly less than half of the fires associated with hot work equipment occurred in home properties. These structure fires were associated with an estimated 15 civilian deaths (81 percent of the total),
79 civilian injuries (66 percent), and $104 million in direct property damage (36 percent).

The data sources do not indicate who was doing the hot work. Consequently, it is not possible to separate out the crafters, artists, and do-it-yourselfers from the professional contractors.

The term home encompasses one- or two-family homes, including manufactured housing and apartments or other multifamily housing. An estimated 1,143 of the home hot work fires (74 percent) occurred in one- or two-family homes each year and they accounted for all 15 of the civilian deaths and an estimated 57 of the civilian injuries (71 percent) each year. Table 1B in the supporting tables document displays this information in greater detail.

Non-home properties include commercial properties and some residential properties. Such residential properties include hotels and motels, boarding and care facilities, and dormitory-type properties. Hot work fires in these properties resulted in an estimated 4 civilian deaths (19 percent), 41 civilian injuries (34 percent), and caused an estimated $188 million (64 percent) in direct property damage each year. Within the non-home designation, the top three most common types of occupancies where these fires occurred were storage properties (26 percent), mercantile or office properties (22 percent), and manufacturing or processing facilities (16 percent). Table 1C in the supporting tables document breaks down this information in greater detail.

### Hot works fires by type of equipment involved

Welding torches were involved in 45 percent of all the hot work fires, including 38 percent of the home fires and 52 percent of the non-home fires. These fires were responsible for most of the civilian injuries and direct property damage. Soldering equipment was involved in many more home fires than non-home fires, while cutting torches were involved in many more non-home fires. Tables 2, 2A, and 2B in the supporting tables document provide more detail regarding this analysis.

### Hot work fires by structure status

Seventy-eight percent of fires involving hot work occurred in structures that were occupied and operating. These fires also accounted for all the civilian deaths, 93 percent of the civilian injuries, and 79 percent of the direct property damage each year. Structures under construction or major renovation accounted for an additional 14 percent of the total fires involving
hot work, 5 percent of the civilian injuries, and 19 percent of the direct property damage.

Sixty-five percent of the direct property damage in home structure fires occurred in occupied structures, while 31 percent occurred in home structures either under construction or major renovation. Tables 3, 3A, and 3B in the supporting tables provide further details on these fires.

**Hot work fires by area of origin**

The area where most home structure fires involving hot work originated was in a wall assembly or concealed space (See Figure 3A), which accounted for 16 percent of the estimated home structure fires. The next most common area of origin was a lavatory, bathroom, locker room, or check room (12 percent). A garage or vehicle storage area (9 percent), exterior wall surface (8 percent), and kitchen or cooking area (8 percent) comprised the rest of the top five areas of origin for home structure fires involving hot work.

These top five areas of origin accounted for half of the civilian injuries and 58 percent of the direct property damage. Table 4A in the supporting tables further breaks down this information.

In non-home structure fires involving hot work, the area of origin differed from those in homes (See Figure 3B). In these fires, the most common area of origin was in an exterior roof or surface (12 percent), followed by a garage or vehicle storage area (8 percent), maintenance or paint shop or area (7 percent), wall assembly or concealed space (7 percent), processing or manufacturing area or workroom (5 percent), and unclassified storage area (5 percent). The fires in these top six categories accounted for nearly half (49 percent) of the civilian injuries and 73 percent of the direct property damage in non-home structure fires. Table 4B of the supporting tables provides further details.

**Hot work fires by item first ignited**

Figure 4A shows that the item first ignited in most of the home structure fires involving hot work was a structural component or finish (64 percent of the total number of fires). These fires accounted for nearly half of the civilian injuries (48 percent) and most of the direct property damage (71 percent). Within this category top detailed items included a structural members or framing (20 percent of fires), insulation within a structural area (17 percent), and exterior wall coverings or finish (10 percent). See Table 5 and 5A of the supporting tables for additional details.
In non-home structure fires involving hot work, the items first ignited differed from those in homes, as seen in Figure 4B. Organic materials (32 percent of the total number fires); adornment, recreational material, or signs (19 percent); liquids, piping, or filters (13 percent); and soft goods or wearing apparel were the top categories of items first ignited in non-home fires. All of the civilian deaths during 2017-2021 occurred in fires where a liquid, piping, or filter was the item first ignited. Together, these top categories accounted for 69 percent of the civilian injuries and 87 percent of the direct property damage in non-home structure fires involving hot work. Complete details of this analysis can be found in Tables 6 and 6A of the supporting tables document.

Hot work fires by factors contributing to ignition

A heat source too close to combustible items and cutting or welding too close to combustible items were the two leading factors contributing to ignition in structure fires involving hot work. Together, they accounted for 59 percent of the fires, 78 percent of the civilian deaths, 54 percent of the civilian injuries, and 40 percent of the direct property damage. Table 7 in the supporting tables document includes the complete details.

Figure 5A shows the leading factors contributing to ignition in home structure fires involving hot work. The top four factors were heat sources too close to combustibles (35 percent of the total number of fires), cutting or welding too close to combustibles (24 percent), equipment not being operated properly (6 percent), and misuse of a material or product (4 percent). These fires accounted for 72 percent of the civilian deaths, 66 percent of the civilian injuries, and 55 percent of the direct property damage annually. Table 7A in the supporting tables document includes further details.
Figure 5B shows the leading factors contributing to ignition in non-home structure fires involving hot work. The two leading factors are similar to those in home structure fires: cutting or welding too close to combustibles (33 percent) and heat sources too close to combustibles (21 percent). The next two leading factors in non-home fires were an arc or spark from operating equipment (5 percent) and equipment not being operated properly (2 percent). These fires accounted for all of the estimated civilian deaths, 54 percent of the civilian injuries, and 71 percent of the direct property damage annually. See Table 7B in the supporting tables document for more details.

Methodology

For the purposes of this analysis, a fire was said to have involved hot work if any of the following NFIRS equipment involved in ignition codes were used on the fire incident report:

- 318 — Power nail gun, stud driver, or stapler
- 331 — Welding torch
- 332 — Cutting torch
- 333 — Burner
- 334 — Soldering equipment
- 354 — Tar pot or tar kettle

Note that the definitions used in this report are those used by NFIRS and do not necessarily correspond with those used in NFPA’s codes and standards.

This analysis excludes structure fires with confined structure fire incident types. These 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 (NFIRS incident types 113–118). Structure fires for this analysis were identified by NFIRS incident types 110–123, excluding incident types 113–118.

The fire statistics in this analysis are national estimates of fires reported to US municipal fire departments and so exclude fires reported only to federal or state agencies or industrial fire brigades. Casualty and loss projections can be heavily influenced by the inclusion or exclusion of one unusually serious fire. Property loss has not been adjusted for inflation.

For details on how specific estimates are calculated, see How NFPA’s National Estimates Are Calculated for Fires.

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