

# Civilian Fire Injuries in Residential Buildings in 2005

These short topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in USFA's National Fire Incident Reporting System (NFIRS). Each topical report briefly addresses the nature of the specific fire or fire-related topic, highlights important findings from the data, and may suggest other resources to consider for further information. Also included are recent examples of fire incidents that demonstrate some of the issues addressed in the report or that put the report topic in context.

## Findings

- Seventy-two percent of civilian fire injuries occur as a result of fires in residential buildings.
- Approximately 39% of civilian fire injuries result from trying to control a fire.
- The leading area for fire injuries in residential buildings is the bedroom.
- The three leading causes for civilian fire injuries are exposure to fire products (82%), exposure to hazardous materials or toxic fumes (6%), and other cause of injury (4%).
- December has the highest incidence of civilian fire injuries (11%).

Fires can strike anywhere—in structures, buildings, automobiles, and the outdoors.<sup>1</sup> Fires that affect our homes are often the most tragic and the most preventable. While the loss of our possessions can be upsetting, the physical and psychological injuries fires inflict are often far more devastating. It is a sad fact, but nearly three-quarters (72%) of all civilian fire injuries occur as a result of fires in residential buildings—our homes. This Topical Fire Report focuses on the characteristics of these injuries.

Civilian fire injuries, by definition, involve people who are injured as a result of a fire. These injuries generally occur from activities of fire control, attempting rescue, or escaping from the dangers of the fire.

In 2005, someone was injured in a residential building fire every 39 minutes. The latest available data for 2005 show that an estimated 13,375 civilian fire injuries resulted from an estimated 376,500 residential building fires.<sup>2,3</sup>

## Civilian Injury Rates for Residential Building Fires

Not all fires produce injuries. When civilian fire injuries are averaged over all residential building fires, the overall injury rate is 3 civilian injuries per 100 residential building fires (Table 1).<sup>4</sup> When someone is injured in a fire, however, on average there is more than one injury. Fires that result in injuries have 124 injuries for every 100 fires.

**Table 1. Injury Rates for Residential Building Fires per 100 Fires (2005)**

Injury-Producing Residential Building Fires	All Residential Building Fires
124.4	2.8

Source: 2005 NFIRS 5.0 data.

## Cause of Injury

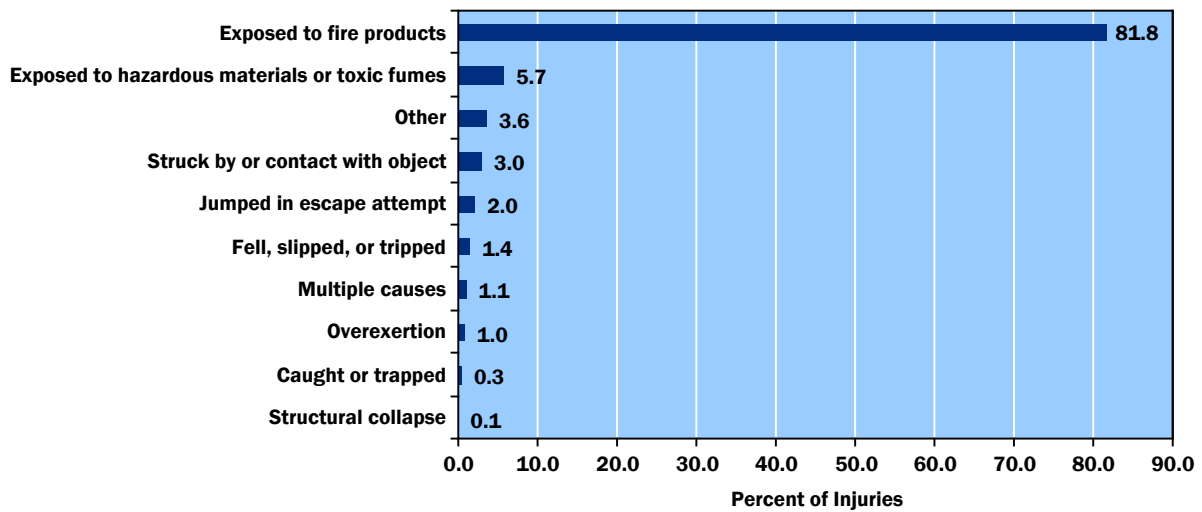
The predominant cause of injury involves exposure to fire products (82%) such as flame, heat, smoke, or gas (Figure 1). The next two leading causes are exposure to hazardous materials or toxic fumes other than smoke (6%), and other (various) causes (4%).

## Types of Injuries

Eighty percent of injuries in residential building fires involve thermal burns and smoke inhalation. Smoke inhalation alone accounts for 39% of residential building fire injuries. Thermal burns (as opposed to scalds or chemical or electrical burns) account for another 27%, and burns combined with smoke inhalation account for an additional 14% (Figure 2). The next leading type of injury, difficulty breathing, accounts for only 6% of injuries, and cuts or lacerations are a small (4%) proportion of civilian fire injuries. Forty-one percent of civilian injuries required transport to emergency facilities.<sup>5</sup>

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**Figure 1. Cause of Injury for Residential Building Fires, 2005.**



Source: 2005 NFIRS 5.0 data.

Thermal burns are caused by contact with flames, hot liquids, hot surfaces, and other sources of high heat. Over 70% of thermal burns to the body were on the upper and lower extremities (57% and 14%, respectively).

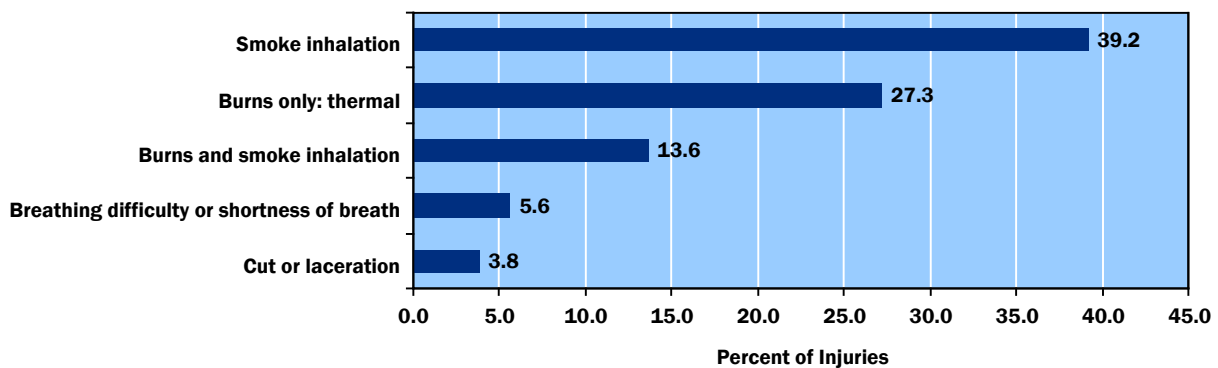
Seventy percent of smoke inhalation injuries are internal injuries, which is particularly critical, as it can lead to lung damage. The inflammation and damage to delicate breathing sacs actually grows worse in the hours after the incident. A chest x-ray can look clear, and oxygen levels in the blood may appear normal in the first few hours after a fire. But a day or two later the victim can take a sudden turn for the worse as the lungs become unable to exchange oxygen properly.<sup>6</sup>

Most civilian fire injuries in residential buildings are minor (65%). Only 11 percent of these injuries are considered serious or life threatening.

**Areas of the Body Affected**

The body parts affected the most by injury (Figure 3) include both internal (30%) and upper extremity injuries (28%). The types of injuries that affect most areas of the body are thermal burns, smoke inhalation, or a combination of both.

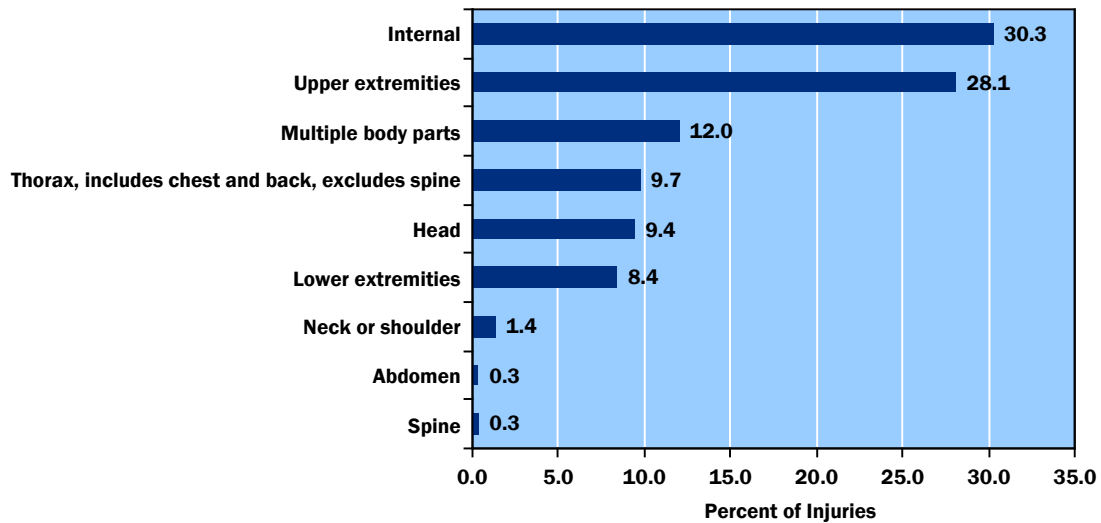
**Figure 2. Leading Symptoms of Injury for Residential Building Fires, 2005.**



Source: 2005 NFIRS 5.0 data.

Note: Percentages computed only for those injuries where symptoms were noted.

**Figure 3. Injuries by Part of Body Injured for Residential Building Fires, 2005.**



Source: 2005 NFIRS 5.0 data.

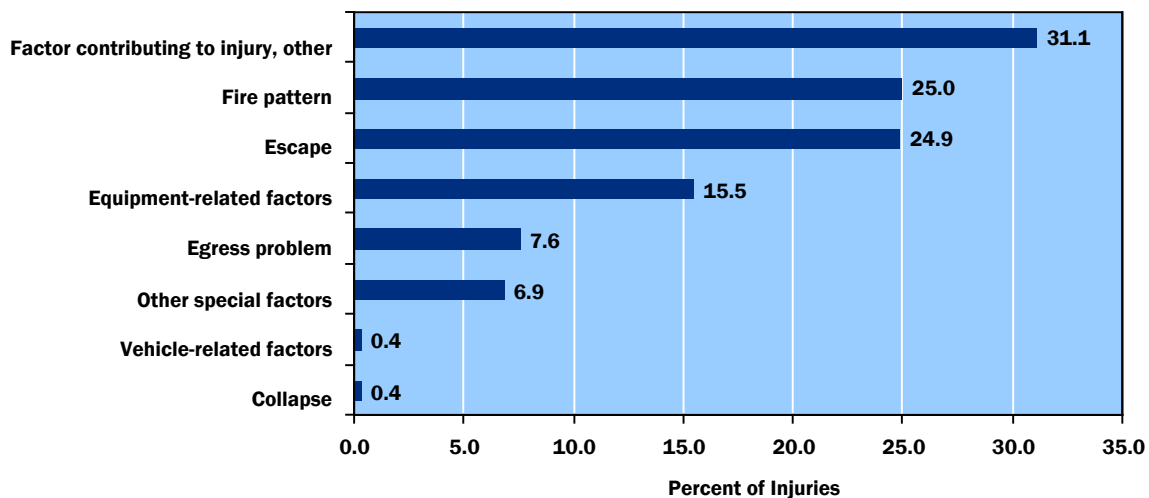
Note: Percentages computed only for those injuries where part of body injured was noted.

**Factors Contributing to Civilian Injuries**

The most notable factors contributing to civilian injuries (outside of “other factors”) (Figure 4) are fire pattern (25%), escape (25%), and equipment-related factors (15%). Fire pattern factors involve situations where exits are blocked by smoke and flame, vision is blocked or impaired by smoke, and civilians are trapped above or below the fire.

Escape factors include unfamiliarity with exits, excessive travel distance to the nearest clear exit, choice of an inappropriate exit route, re-entering the building, and clothing catching on fire while escaping. Equipment-related problems include such factors as the improper use of cooking or heating equipment and the use of unvented heating equipment.

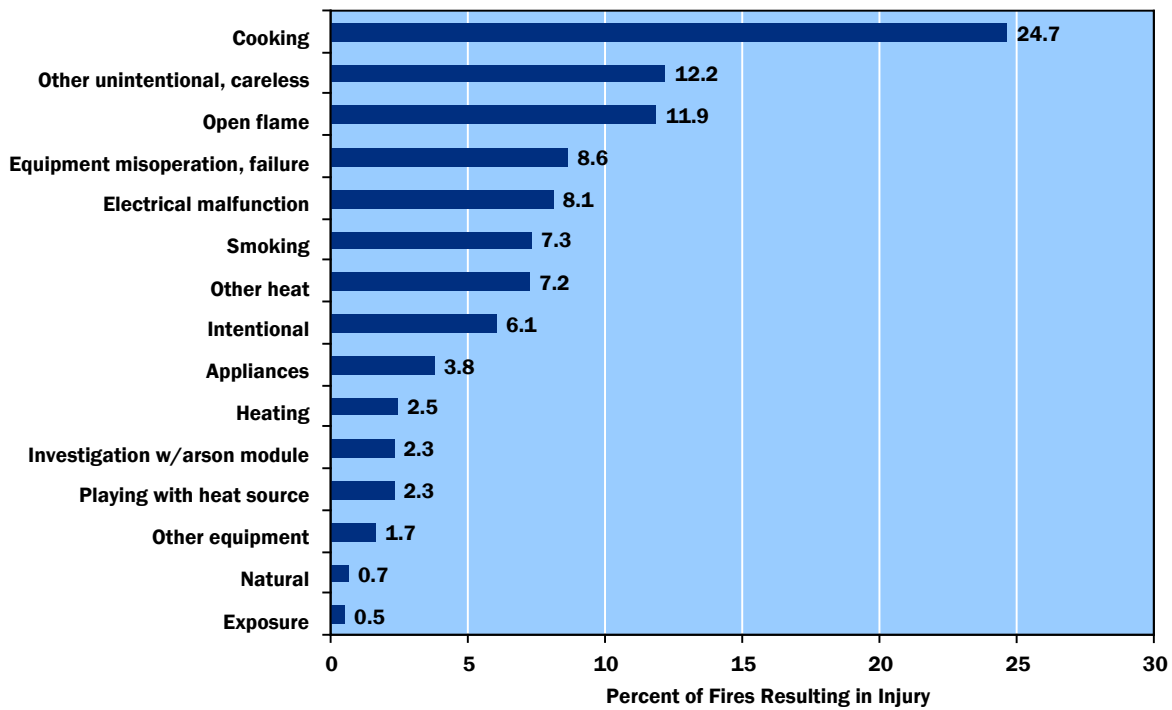
**Figure 4. Factors Contributing to Civilian Injuries for Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

Note: Includes incidents where factors contributing to injury were specified. As multiple factors contributing to injury may be noted for each injury, the distribution may sum to more than 100%.

**Figure 5. Cause of Residential Building Fires Resulting in Injury, 2005.**



Source: NFIRS 5.0 data.

### **Cause of Fires that Result in Injury**

Cooking is the primary cause for fires 25% of the time when injuries occur (Figure 5). Other unintentional or careless fires as well as open-flame fires each yield 12% of injuries. Fires where equipment misoperates or fails produce 9% of injuries. Electrical malfunction fires generate 8% of injuries.

### **Civilian Activity When Injured**

Most civilian injuries occur when the victim is attempting to control the fire (39%) followed by escaping (23%) and sleeping (11%), as shown in Figure 6. Unless a fire is small and confined, such as a small trashcan fire, leave fire control to trained firefighters who wear protective gear and have extensive knowledge of fire control. To escape a fire, many civilians make the mistake of fleeing through the area where the fire is located. The area of a fire has tremendous heat, smoke, and a toxic atmosphere that can render a

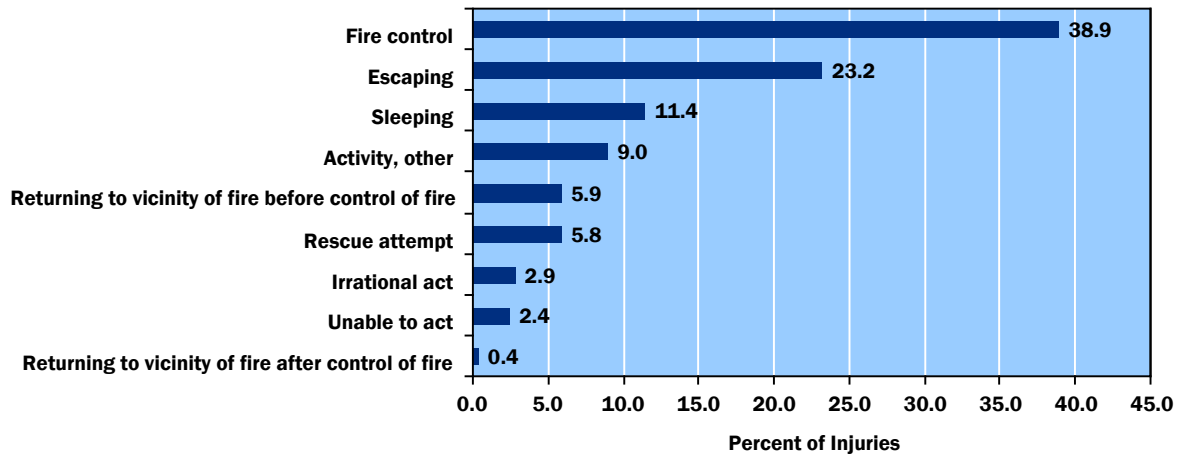
person unconscious. If you cannot get out of the residence safely, call for help and stay in a room with the door closed until firefighters arrive. Smoke alarms are more effective for waking people when they are asleep during a fire than a person’s sense of smell. A person cannot wake up from the smell of fire while sleeping.<sup>7</sup>

### **Gender, Race, and Ethnicity of Civilian Injuries**

Males accounted for 53% of injuries, and women accounted for 47% of the injuries. Civilian injuries sorted by race show that Whites are injured 68% of the time followed by Blacks or African-Americans (23%), Other, including multiracial (6%), Asian (2%), American Indian or Alaska Native (1%), and Native Hawaiian or other Pacific Islander (less than 1%) (Figure 7).

Eighty-five percent of injured civilians were Non-Hispanic or Non-Latino. The remaining 15% were Hispanic or Latino.

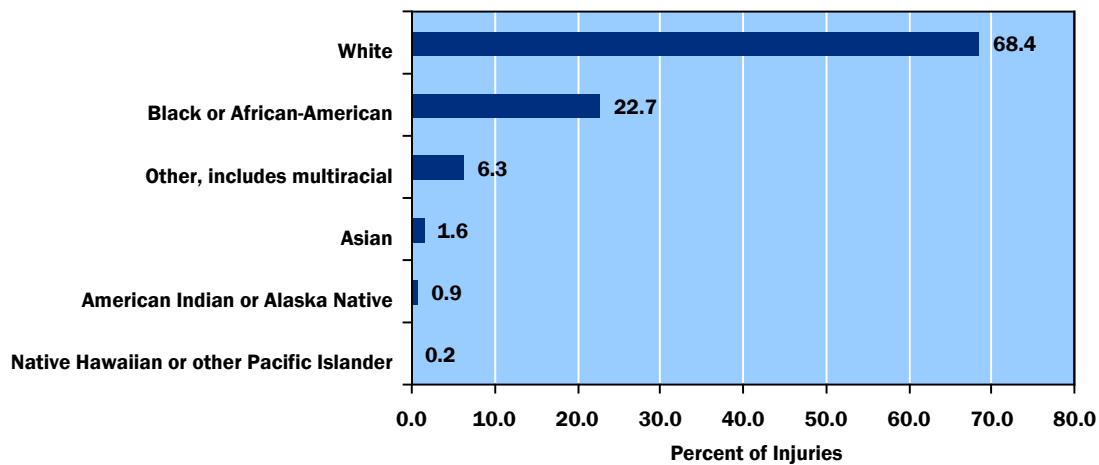
**Figure 6. Activity When Injured for Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

Note: Percentages computed for only those injuries where activity information was available.

**Figure 7. Civilian Injuries by Race in Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

Note: Percentages computed for only those injuries where race information was available.

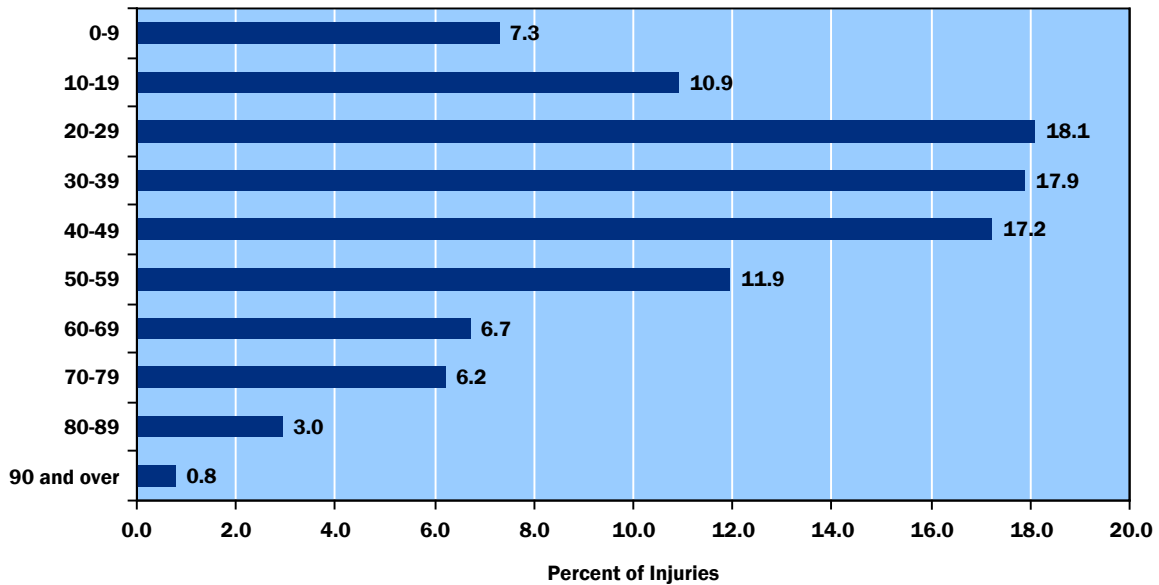
**Age of Civilians Injured and Activity While Injured**

Over half (53%) of civilians injured in residential building fires are between the ages of 20 and 49 (Figure 8). On average, civilians between the ages of 20 and 49 primarily get hurt by trying to control a fire (44%) or escaping (19%). Except for the very young or very old, the first reaction of civilians of all ages is to try to put out the fire or escape.

In contrast, the young and the elderly are less likely to be as mobile or ready to act in a fire situation. Infants, young

children, the disabled, or the elderly require special provisions in a fire or emergency situation. Children under 10 years of age, in particular, usually try to “escape” by hiding in a closet or under a bed when frightened in a fire situation. Children are injured trying to escape (46%) and when sleeping (24%). Older adults 70 years and over on average get injured 29% of the time trying to control a fire, 28% trying to escape, and 13% while sleeping. The oldest adults (aged 90 and over) are more likely to be bedridden and unable to act 21% of the time.

**Figure 8. Civilian Injury by Age for Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

Note: Percentages computed only for those injuries where age was valid.

### Where Civilian Injuries Occur

The specific location at the time of injury mostly occurs in bedrooms with fewer than five people (32%); common rooms such as a den, family room, living room, or lounge (11%); and cooking areas (11%).

While not a specific room in the home, egress areas account for 17% of injuries. Exits such as corridors, stairways, and doors can get filled with smoke, fire, or extreme heat making escape routes treacherous.

### When Civilian Injuries Occur in Residential Buildings

Civilian injuries follow a daily pattern (Figure 9). Nighttime injuries peak between 1 a.m. and 2 a.m. (5%). These consist mostly of smoke inhalation injuries. Injuries then steadily decrease to the lowest point of the day, between 7 a.m. and 8 a.m. (3%). In general, injuries then steadily increase during the daytime hours with a slight peak between the hours of noon and 1 p.m. (5%) where thermal burns and smoke inhalation are the primary symptoms. Injuries are highest during the early evening hours between 6 p.m. and 7 p.m. (6%) where thermal burns and smoke inhalation are also in force. Cooking is the leading cause for fires throughout the day and provides many opportunities for injury.

Civilian injuries tend to follow a seasonal trend with more injuries taking place during the colder months (Figure 10) than the warmer months. Overall, December produces the

most injuries and has higher than average smoke inhalation injuries (39%). September has the least number of injuries. This drop may be explained by a decrease in residential building heating fires and their associated injuries during the warmer months.<sup>8</sup>

### Examples

The following recent examples illustrate fire scenarios in which civilian injuries have occurred.

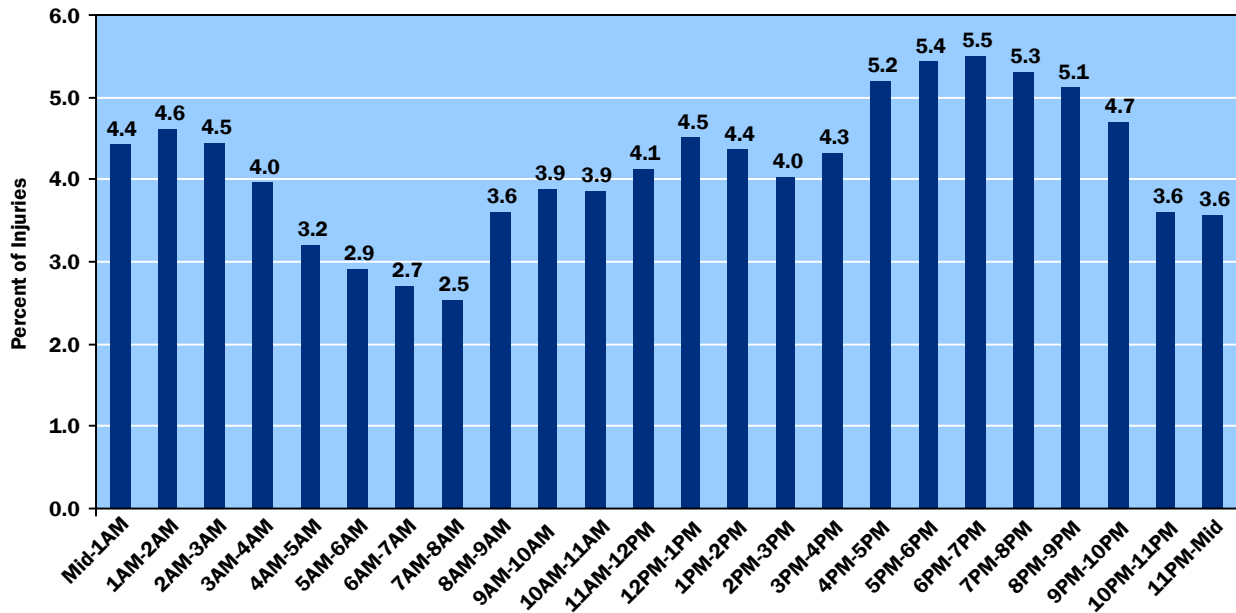
June 2007, Rosenberg, TX: A Rosenberg woman was seriously burned in a fire when a companion lit a cigarette while she was using fingernail polish remover. Fumes from the acetone in the polish remover ignited, and burned the couple in their bed.<sup>9</sup>

February 2008, Detroit, MI: A house explosion injured five people, including three children, and fire officials were investigating whether someone had tampered with the gas service. Two women in their 40s were also injured. The victims suffered second and third degree burns.<sup>10</sup>

February 2008, Manhattan, NY: An early morning blaze in a stationery store led to the evacuation of tenants from a luxury apartment building. Fourteen residents were injured. One resident’s description was “they were woken by the smoke creeping into their apartments. The hallways and stairwells were clogged with smoke—there was no exit possible.”<sup>11</sup>

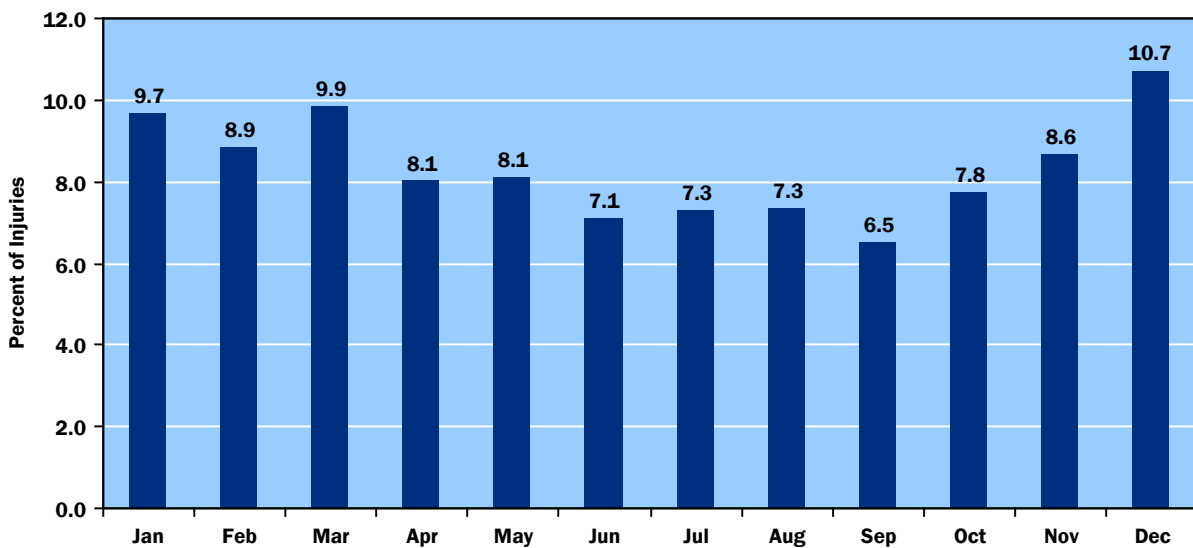
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**Figure 9. Time of Day of Occurrence for Civilian Injuries for Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

**Figure 10. Civilian Injuries by Month for Residential Building Fires, 2005.**



Source: NFIRS 5.0 data.

### Escape Planning for Residential Buildings

Everyone should know how to escape from their residence. Leave fighting a fire to trained firefighters unless it is a small, easily controllable fire. Instead, focus efforts on following a pre-set escape plan.

A home filled with smoke is a very dangerous situation. Smoke blocks vision, and the toxic gases can cause dizziness

and disorientation. Under these conditions, one can easily become lost or trapped in the home. Therefore, the first step in an escape plan is to make sure smoke alarms are in good working order.

Most civilian injuries are caused by trying to control a fire. Unless a fire is small and confined, call for help and leave fire control to trained firefighters. The peak time for

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injuries is the early evening hours. Injuries are highest in the month of December. The majority of civilian injuries consist of smoke inhalation and thermal burns.

Leading factors contributing to civilian injuries largely consist of situations where exits are blocked by fire, vision is impaired by smoke, or civilians are trapped above or below the fire. Unfamiliarity with exits, excessive distance to the

nearest exit, or an inappropriate choice of exit can hinder a crucial escape.

A first step in an escape plan is to make sure smoke alarms are in good working order. Plan and practice at least two escape routes for every room and have procedures in place for those who require additional help such as infants, the elderly, and the disabled.

## Notes:

<sup>1</sup>In NFIRS 5.0, a structure is a constructed item of which a building is one type. The term “residential structure” commonly refers to buildings where people live. The definition of a residential structure fire has, therefore, changed to include only those fires where the NFIRS 5.0 structure type is 1 or 2 (enclosed building and fixed portable or mobile structure) with a residential property use. Such fires are referred to as “residential buildings” to distinguish these buildings from other structures on residential properties that may include fences, sheds, and other uninhabitable structures. In addition, incidents that have a residential property use, but do not have a structure type specified are presumed to be buildings.

<sup>2</sup>NFIRS 5.0 contains both converted NFIRS 4.1 data and native NFIRS 5.0 data. This topical report includes only native 5.0 data and excludes incident type ‘110’ since it is a 4.1 conversion code.

<sup>3</sup>National estimates are based on 2005 native version 5.0 data from the National Fire Incident Reporting System (NFIRS) and residential structure fire loss estimates from the National Fire Protection Association’s (NFPA) annual survey of fire loss. Fires are rounded to the nearest 100 and injuries to the nearest 25.

<sup>4</sup>Fire injury rates computed from national estimates will not agree with injury rates computed from NFIRS data alone. Fire injury rates computed from national estimates would be  $(100 * (13,375 / 8,500)) = 157.4$  injuries per 100 injury-producing residential building fires and  $(100 * (13,375 / 376,500)) = 3.6$  injuries per 100 residential building fires.

<sup>5</sup>If the incidents with unknown disposition are distributed in the same proportion as the incidents with known disposition, then this percentage would rise to 97%.

<sup>6</sup>“Doctors: Smoke Inhalation Victim Can Seem Fine, Go Into Lung Failure Suddenly,” Sheryl Ubelacker, *EMS Responder* (Toronto, Canada) <http://publicsafety.com/article/article.jsp?id=1220&siteSection=15>

<sup>7</sup>“Scents Will Not Rouse Us From Slumber, Says New Brown University Study.” *Science Daily*, May 2004, (Providence, RI) <http://www.sciencedaily.com/releases/2004/05/040518075747.htm>

<sup>8</sup>*Heating Fires in Residential Buildings*. USFA, <http://www.usfa.dhs.gov/downloads/pdf/tfrs/v6i3.pdf>

<sup>9</sup>“Woman Doing Nails In Bed Suffers Burns When Man Lights Up A Smoke.” Bob Dunn, *FortBendNow* (Richmond, TX) <http://www.fortbendnow.com/news/3070/woman-doing-nails-in-bed-suffers-serious-burns-when-man-lights-up-a-smoke>

<sup>10</sup>“Five Injured in Detroit Home Explosion.” *Associated Press*, [http://ap.google.com/article/ALeqM5i\\_A0BXlGA92Rmc3SMMHLCYR8s1yQD8URQ7C00](http://ap.google.com/article/ALeqM5i_A0BXlGA92Rmc3SMMHLCYR8s1yQD8URQ7C00)

<sup>11</sup>“Alarm Was Off in Building Where Fire Injured 33.” John Sullivan *The New York Times* (NYC, NY) <http://cityroom.blogs.nytimes.com/2008/02/07/alarm-was-off-in-building-where-fire-injured-33/>