University Housing Fires

These topical reports are designed to explore facets of the U.S. fire problem as depicted through data collected in the U.S. Fire Administration's (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

- An estimated 3,800 university housing fires occur each year in the United States.
- Eighty-three percent of university housing fires are cooking fires. Small, confined cooking fires account for 77 percent of university housing fires. Cooking fires account for 6 percent of all nonconfined university housing fires.
- University housing fires peak in September and October; this peak accounts for 23 percent of fires.
- The three main causes of nonconfined university housing fires are intentionally set fires (17 percent), open flames (15 percent), and other unintentional causes (12 percent).
- One-fifth of nonconfined university housing fires in bedrooms are started by candles.

From 2005 to 2007, an estimated 3,800 university housing fires occurred annually in the United States. These fires accounted for less than one percent of residential building fires responded to by fire departments across the Nation.[1,2,3] These fires resulted in an average of approximately 5 deaths, 50 injuries, and $26 million in property loss each year. This topical report addresses the characteristics of university housing fires reported to the National Fire Incident Reporting System (NFIRS) between 2005 and 2007. In NFIRS, university housing fires are considered to be fires in college and university residential buildings that include dormitories and fraternity and sorority houses.

The U.S. Consumer Product Safety Commission (CPSC) reports an increase in dormitory and university housing fires in recent years. Students bring more items from home to make their college stays more comfortable, including high-powered electronic equipment and appliances. However, the equipment can be dangerous when used improperly or left unsupervised, especially in dormitory rooms. The CPSC reported that fires are more common during the evening hours and weekends when most students are in the residence halls. Most of the fires are cooking-related (hot plates, microwaves, portable grills, etc.), but the majority of deaths occur in bedrooms. In August 2007, the CPSC, the United States Fire Administration (USFA), the National Fire Protection Association (NFPA), and the University of Maryland's Fire Marshal urged students, families, and school administrators to be aware of the fire hazards and to take precautions.[4]

Types of Fires

Building fires consist of two major categories of incidents: fires that are confined to specific types of equipment or objects (confined fires) and those that are not (nonconfined fires). Confined building fires are small fire incidents that are limited in scope, confined to noncombustible containers, rarely result in serious injury or large content losses, and expected to have no significant accompanying property losses due to flame damage.[5] Eighty-four percent of university housing fires are confined fires as shown in Table 1.

Table 1. University Housing Fires by Type of Incident (2005–2007)

Incident Type	Percent
Nonconfined fires	16.4
Confined fires	83.6
Cooking fire, confined to container	76.5
Chimney or flue fire, confined to chimney or flue	0.3
Incinerator overload or malfunction, fire confined	0.2
Fuel burner/boiler malfunction, fire confined	0.9
Commercial compactor fire, confined to rubbish	0.2
Trash or rubbish fire, contained	5.4
Total	100.0

Source: NFIRS 5.0

Loss Measures

Table 2 presents losses, averaged over this 3-year period, for residential building fires and university housing fires reported to NFIRS.[6]

Table 2. Loss Measures for University Housing Fires (3-year average, 2005–2007)

Measure	Residential Building Fires	University Housing Fires	Confined University Housing Fires	Nonconfined University Housing Fires
Average Loss:				
Fatalities/1,000 Fires	5.4	0.7	0.0	4.4
Injuries/1,000 Fires	28.1	9.5	2.1	47.2
Dollar Loss/Fire	$14,560	$5,730	$80	$34,420

Source: NFIRS 5.0
Note: Average loss for fatalities and injuries is computed per 1,000 fires; average dollar loss is computed ***per fire*** and is rounded to the nearest $10.

Table 3 presents the percentage distribution of property use for all university housing fires, confined university housing fires, and nonconfined university housing fires. Fires in dormitories and dormitory-type residences account for 94 percent of all university housing fires. These fires also account for 96 percent of confined university housing fires and 88 percent of nonconfined university housing fires. While a substantially smaller portion of university fires in general, fires in sorority and fraternity houses play a larger role in the bigger fires, accounting for 13 percent of nonconfined fires compared to 4 percent of confined fires.

Table 3. Percentage Distribution of Property Use for University Housing Fires (3-year average, 2005–2007)

Property Use	All University Housing Fires	Confined University Housing Fires	Nonconfined University Housing Fires
Dormitory and Dormitory-type residence	94.3%	95.6%	87.5%
Sorority House, Fraternity House	5.7%	4.4%	12.5%

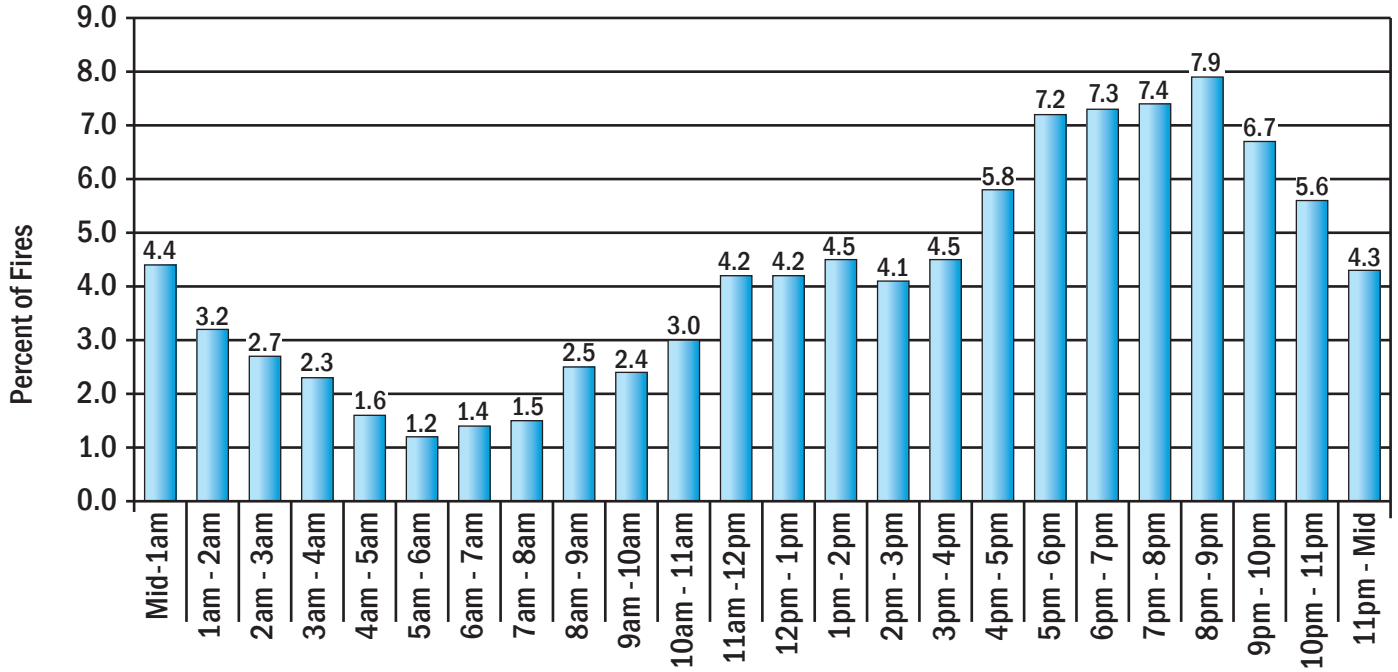
Source NFIRS 5.0

When University Housing Fires Occur

As shown in Figure 1, university housing fires occur mainly in the early evening hours from 5 p.m. to 10 p.m., peaking from 8 p.m. to 9 p.m., and then declining throughout the night and early morning reaching the lowest point during the morning hours (5 a.m. to 6 a.m.).[7] The distribution of fires during the day is much like that of residential fires overall with the evening peak longer and later. Most likely, the timing corresponds to when students prepare snacks or cook their evening meals.

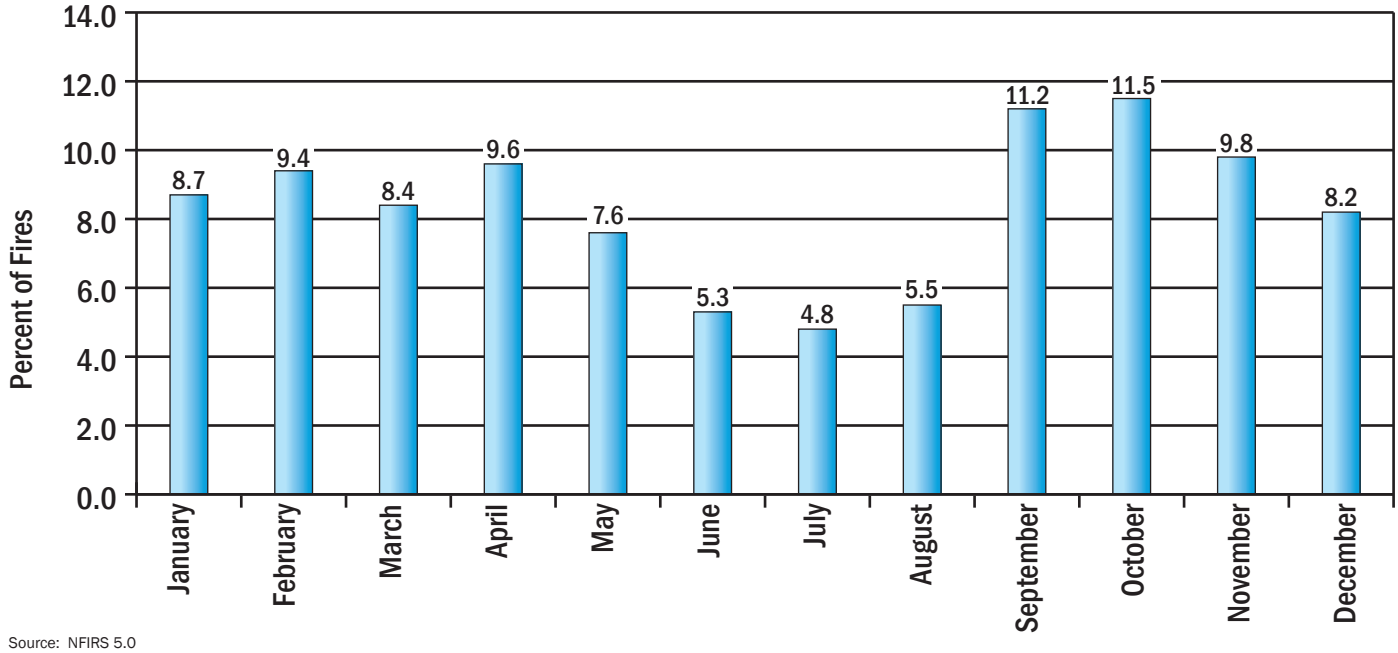
University housing fires peak in September and October as shown in Figure 2. This peak of fire activity corresponds to the beginning of the traditional academic year. September and October account for approximately 23 percent of all university housing fires. From November through April, fires fluctuate between 8 and 10 percent, accounting for 54 percent of all university housing fires. Fires begin to decline in May when the academic year winds down. Fire incidence is lowest during the months of June through August, corresponding to lower student attendance during summer sessions.

Figure 1. University Housing Fires by Time of Alarm (2005–2007)



Source: NFIRS 5.0

Figure 2. University Housing Fires by Month (2005–2007)



Source: NFIRS 5.0

Causes of University Housing Fires

Eighty-three percent of all university housing fires are cooking fires as shown in Table 4. The next four causes combined account for 9 percent of university housing fires: intentionally set fires (3 percent), open flame fires (2 percent), heating fires (2 percent), and other unintentional or careless fires (2 percent). Candle fires, a subset of open-flame fires, account for 1 percent of all university housing fires. Candle fires have been of much concern in university housing. Only a small number of these fires are reported to NFIRS. This lack of reporting could be due to campus regulations banning candles combined with the lack of data from confined fires.

Table 4. Leading Causes of University Housing Fires (2005–2007)

Cause	Percent (Unknowns Apportioned)
Cooking	83.1
Intentional	3.1
Open Flame	2.3
Heating	1.8
Other Unintentional, Careless	1.8

Source: NFIRS 5.0

Confined Fires

Confined fires are allowed abbreviated NFIRS reporting and many reporting details of the fire are not required and not reported. The three major areas where data are available—time of day, month, and cause—confined fires dominate the overall university housing fire profile. Thirty-nine percent of confined fires occur between 5 p.m. and 10 p.m., peaking between 8 p.m. and 9 p.m. Confined fires in university housing fires peak in September and October, decline through May and are lowest during the months of June through August. Cooking is the cause of 96 percent of these confined fires.

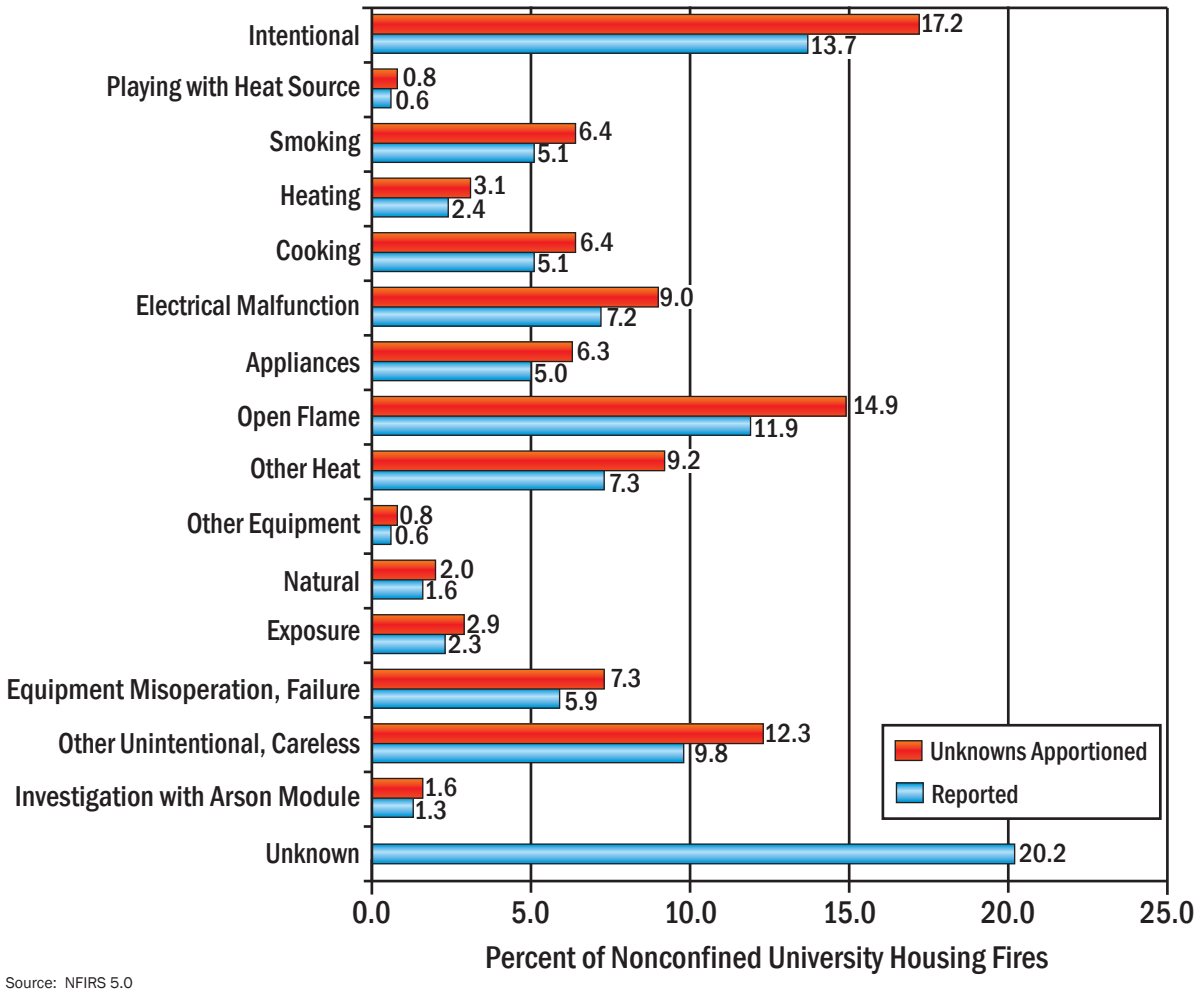
Nonconfined Fires

The next sections of this Topical Report address nonconfined university housing fires, where detailed fire data are available.

Causes of Nonconfined University Housing Fires

While cooking is the leading cause of university housing fires overall, it only represents 6 percent of all nonconfined university housing fires. Intentionally set fires (17 percent), fires caused by open flames (15 percent), and other unintentional causes (12 percent) are the leading causes of nonconfined university housing fires (Figure 3).

Figure 3. Causes of Nonconfined University Housing Fires (2005–2007)



Source: NFIRS 5.0

Where Nonconfined University Housing Fires Start (Area of Fire Origin)

Most nonconfined university housing fires begin in the bedroom (23 percent) or cooking areas and kitchens (20 percent). Fires that start in bathrooms and locker rooms (7 percent), hallways (6 percent), common rooms or lounge areas (5 percent), and laundry areas (5 percent) account for an additional 23 percent (Table 5).

Table 5. Leading Areas of Fire Origin in Nonconfined University Housing Fires (2005–2007)

Area of Origin	Percent (Unknowns Apportioned)
Bedrooms	22.7
Cooking area, kitchen	19.9
Bathroom, checkroom, lavatory, locker room	7.2
Hallway corridor	6.1
Common room, den, family room, living room, lounge	5.1
Laundry area	4.9

Source: NFIRS 5.0

For intentionally set nonconfined fires, 31 percent are set in hallways or corridors of the building. Fires set in bathrooms account for an additional 12 percent of intentionally set nonconfined fires. Eleven percent of intentionally set nonconfined fires start in bedrooms, 8 percent occur in lounges or common rooms, and 3 percent start in kitchens or cooking areas.

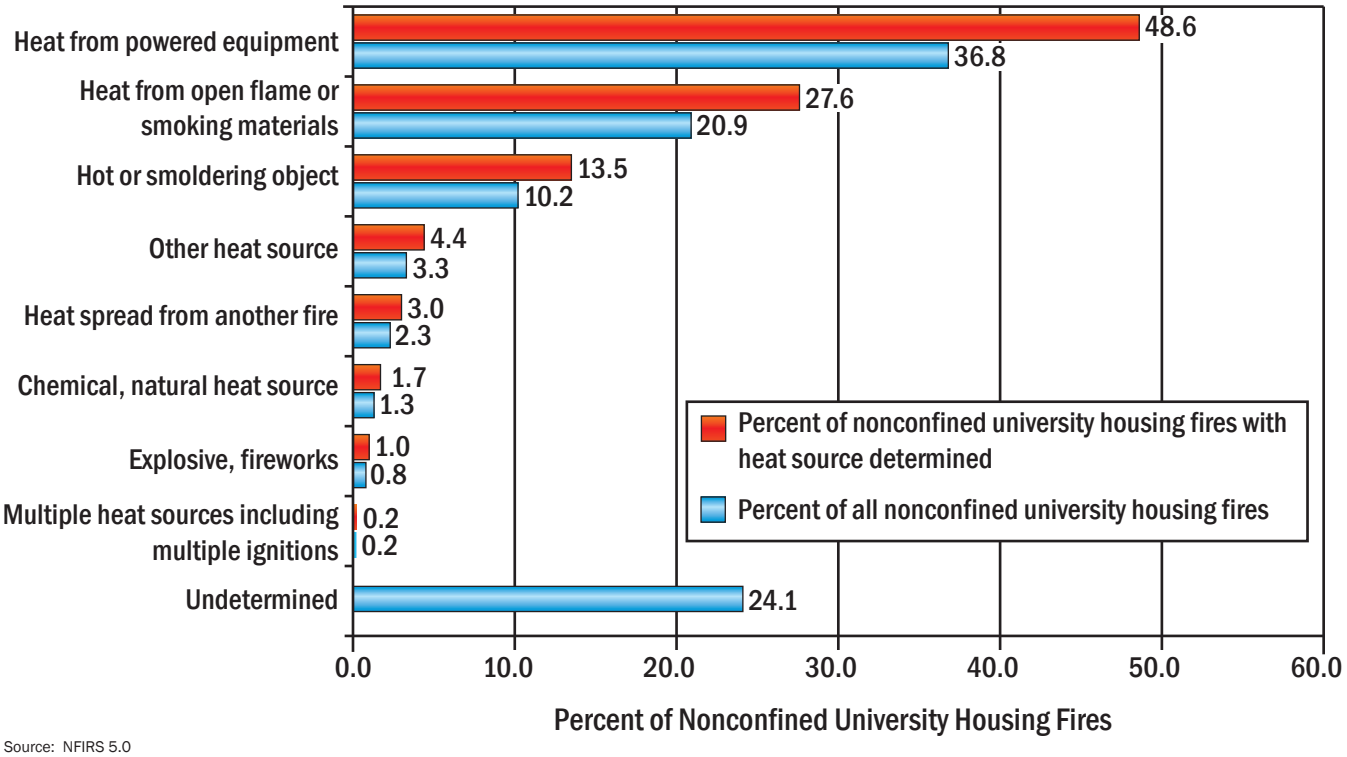
Fires involving open flame in bedrooms account for 42 percent of all nonconfined university housing open-flame fires. Nonconfined university housing open-flame fires start in lounges or common rooms (9 percent) and bathrooms (9 percent), accounting for an additional 18 percent.

Fires in kitchens and cooking areas account for the vast majority of other unintentional nonconfined fires (49 percent). Fires in bedrooms account for 26 percent of other unintentional nonconfined fires.

How Nonconfined University Housing Fires Start (Heat Source)

Figure 4 shows sources of heat in nonconfined university housing fires. Heat from powered equipment accounts for 49 percent of nonconfined university housing fires. Within this category, radiated or conducted heat from operating equipment accounts for 19 percent of all fires and heat from other powered equipment accounts for 16 percent of all nonconfined university housing fires. Heat from open flame or smoking materials accounts for 28 percent of nonconfined university housing fires. This category includes candles, cigarettes, lighters, and matches. The third largest category pertains to hot or smoldering objects (14 percent). This category includes hot embers or ashes, molten, hot material, and heat sparked from friction.

Figure 4. Sources of Heat in Nonconfined University Housing Fires (2005–2007)



Source: NFIRS 5.0

As a third of the causes of nonconfined university housing fires specifically include equipment, it is not surprising that the leading heat source for those fires is heat from powered equipment (92 percent).[8] Of the 23 percent of the fires that occur in bedrooms (Table 5), 10 percent are started by heat from powered equipment, 19 percent are started by radiated or conducted heat from operating equipment, and 12 percent are started by electrical arcing. Interestingly, 20 percent of nonconfined university housing fires in bedrooms are started by candles (these data are not available for confined fires). This finding supports the policies enforced by several universities to prohibit candle usage in dormitories and other campus housing.

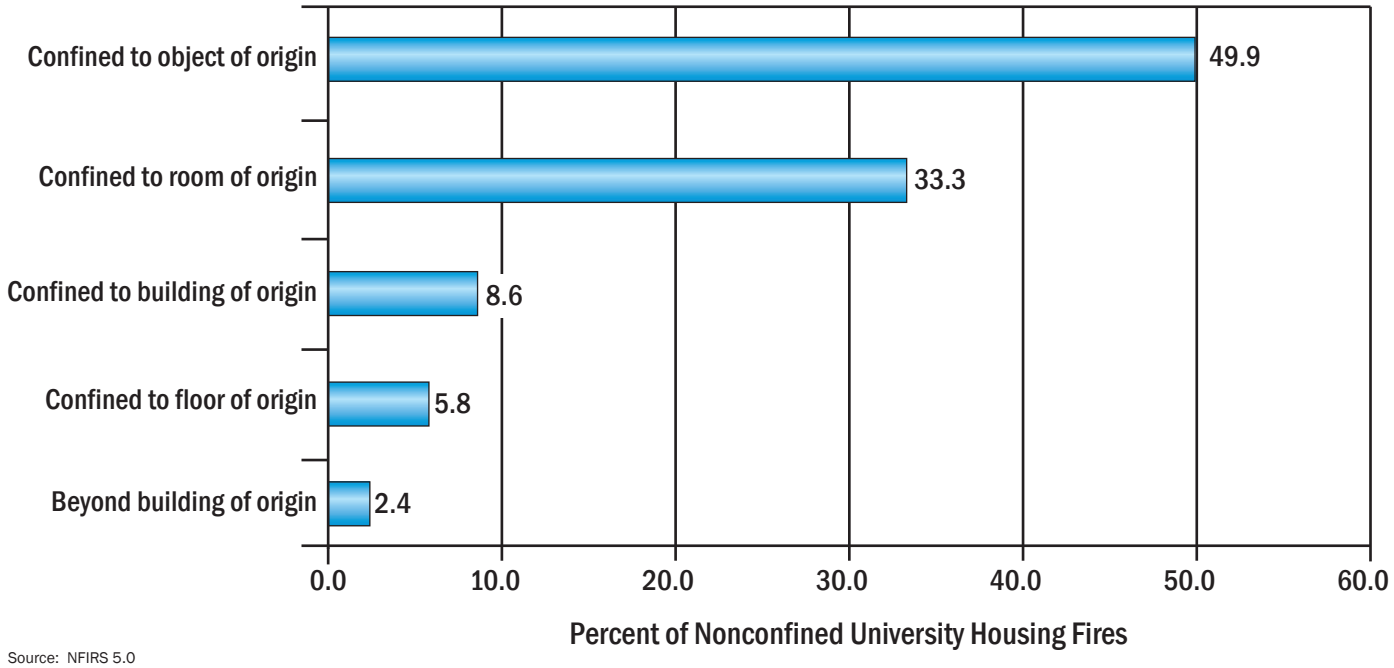
For the 20 percent of nonconfined university housing fires that occur in kitchens or cooking areas, 37 percent are started by radiated or conducted heat from operating equipment, 27 percent are started by heat from powered equipment, and 5 percent are started by electrical arcing.

Fire Spread in Nonconfined University Housing

Fire spread in nonconfined university housing is generally contained to the object of fire origin (50 percent) or to the room of fire origin (33 percent) as shown in Figure 5.

When these statistics are combined with the implied fire spread for confined fires (that is, confined fires are implied to be confined to the object of origin), over 90 percent of all university housing fires are confined to the object of origin.

Figure 5. Extent of Fire Spread in Nonconfined University Housing Fires (2005–2007)



Source: NFIRS 5.0

Factors Contributing to Ignition

Table 6 shows the leading factors contributing to ignition of nonconfined university housing fires. Placing a heat source too close to combustible objects is the leading contributing factor (17 percent). Abandoned or discarded materials are a contributing factor in 16 percent of nonconfined university housing fires and the general misuse of materials or products is a contributing factor in 13 percent of the fires. These 3 contributing factors play a role in 45 percent of nonconfined university housing fires.[9]

Table 6. Leading Factors Contributing to Ignition for Nonconfined University Housing Fires (Where Factor Contributing Specified, 2005–2007)

Factors Contributing to Ignition	Percent of Nonconfined University Housing Fires (Unknowns Apportioned)
Heat source too close to combustibles	16.8
Abandoned or discarded materials or products	15.5
Unspecified misuse of material or product	12.9

Source: NFIRS 5.0
Notes: Includes only incidents where factors that contributed to the ignition of the fire were specified. Multiple factors contributing to fire ignition may be noted for each incident.

Smoke Alarms

Smoke alarm data are available for both confined and nonconfined fires although for confined fires, the data are very limited in scope.

In 9 percent of nonconfined university housing fires there were no smoke alarms present (Table 7). In another 9 percent of these fires, firefighters were unable to determine if a smoke alarm was present. Smoke alarms were present in 82 percent of nonconfined university housing fires. Smoke alarms are known to have operated in 63 percent of nonconfined university housing fires. In 6 percent of nonconfined university housing fires where smoke alarms were present, the alarms failed to operate.

In 13 percent of confined university housing fires, the smoke alarm effectiveness was unknown (Table 8). Smoke alarms operated and alerted occupants in 83 percent of these confined fires. In 4 percent of confined university housing fires, the occupants were not alerted by the smoke alarm.[10] Note that the data presented in Table 7 and Table 8 are the raw counts from the NFIRS data set and not scaled to national estimates of smoke alarms in university housing fires.

Table 7. NFIRS Smoke Alarm Data for Nonconfined University Housing Fires (NFIRS, 2005-2007)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		107	9.4
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	617	54.0
		Smoke alarm alerted occupants, occupants failed to respond	36	3.1
		No occupants	37	3.2
		Smoke alarm failed to alert occupants	6	0.5
		Undetermined	20	1.7
	Smoke alarm failed to operate		53	4.6
	Undetermined		60	5.2
None present			99	8.7
Undetermined			108	9.4
Total Incidents			1,143	100.0

Source: NFIRS 5.0

Notes: The data presented in Table 7 are raw data counts from the NFIRS data set. They do not represent national estimates of smoke alarms in university housing fires. They are presented for informational purposes. Total may not add to 100 percent due to rounding.

Table 8. NFIRS Smoke Alarm Data for Confined University Housing Fires (NFIRS, 2005-2007)

Smoke Alarm Effectiveness	Count	Percent
Smoke alarm alerted occupants	4,828	83.1
Smoke alarm did not alert occupants	209	3.6
Unknown	772	13.3
Total Incidents	5,809	100.0

Source: NFIRS 5.0

Notes: The data presented in Table 8 are raw data counts from the NFIRS data set. They do not represent national estimates of smoke alarms in university housing fires. They are presented for informational purposes. Total may not add to 100 percent due to rounding.

Automatic Extinguishing Systems

Automatic extinguishing system (AES) data—primarily sprinkler systems in residential buildings—are also available for both confined and nonconfined fires, but for confined fires, an AES was present in less than 1 percent of reported incidents.[11] Note that the data presented in Table 9 are the raw counts from the NFIRS data set and are not scaled to national estimates of AESs in university housing fires.

In 39 percent of nonconfined university housing fires, full or partial AESs were present (Table 9). The presence of suppression systems—sprinkler systems most likely—was higher in nonconfined university housing fires than in any other residential property type except for hotels and motels (41 percent), possibly as a result of code requirements. Fifty-seven percent of university housing fires had no AES present, and the presence of an AES was undetermined in 4 percent of the fires.

Table 9. NFIRS Automatic Extinguishing System (AES) Data for Nonconfined University Housing Fires

AES Presence	Count	Percent
AES present	446	39.0
Partial system present	3	0.3
AES not present	649	56.8
Unknown	45	3.9
Total	1,143	100.0

Source: NFIRS 5.0.
Notes: The data presented in this table are raw data counts from the NFIRS data set. They do not represent national estimates of AESs in nonconfined university housing fires. They are presented for informational purposes.

Examples

The following are some recent examples of university housing fires that were reported by the media:

- May 2009: Two Central Connecticut State University students were accused of setting off the fire alarms with burning popcorn after they tied the doors shut to several dorm rooms. Their intent was to pull a prank in the residence hall. Police and firefighters secured the scene. No one was injured during the incident.[12]
- May 2009: Several Northern Illinois University students were displaced after a fire broke out in their fraternity house. One person was taken to a hospital with non-life-threatening injuries. The cause of the fire is unknown, but it started on a sofa on the front porch of the house. Smoking materials have not been ruled out as the cause of ignition.[13]
- April 2009: Beaumont firefighters determined that a Lamar University residence hall fire was caused by a bathroom vent fan that was left running while no one was in the room. It appears that the motor had shorted or overheated, caught on fire, and burned a portion of the bathroom. The fire was confined to the bathroom, and the residence hall's sprinkler system activated, putting out the flames. The fire alarms alerted students and staff, and everyone evacuated the residence hall.[14]
- May 2009: Quick responses by the local fire department and employees of the University of the Cumberlands attributed to containing a small fire in a residence hall caused by a burning stove and microwave oven. No one was hurt during the fire, and the building sustained only minor damage.[15]

Conclusion

University housing fires have become the focus of increased attention within the State and Federal governments, local and State fire departments, affected neighborhoods and communities, and the criminal justice system. This is largely because they account for and cause injuries and deaths as well as property damage. An estimated 3,800 university housing fires occur each year in the United States. The challenge for communities and the fire service is to pinpoint the reasons why university housing fires occur and to address these issues to prevent future fires, deaths, injuries, and severe property damage. Providing students with fire safety education upon their arrival to the universities may help increase awareness and prevent fires.

NFIRS Data Specifications for University Housing Fires

Data for this report were extracted from the NFIRS annual Public Data Release (PDR) files for 2005, 2006, and 2007. Only version 5.0 data were extracted.

University housing fires were defined as:

- Incident types 111 to 123:

Incident Type	Description
111	Building fire
112	Fires in structure other than in a building
113	Cooking fire, confined to container
114	Chimney or flue fire, confined to chimney or flue
115	Incinerator overload or malfunction, fire confined
116	Fuel burner/boiler malfunction, fire confined
117	Commercial compactor fire, confined to rubbish
118	Trash or rubbish fire, contained
120	Fire in mobile property used as a fixed structure, other
121	Fire in mobile home used as fixed residence
122	Fire in motor home, camper, recreational vehicle
123	Fire in portable building, fixed location

Note that incident types 113 to 118 do not specify if the structure is a building.

Incident type 112 is included as previous analyses have shown that incident types 111 and 112 are used interchangeably.

- Aid types 3 (Mutual aid given) and 4 (Automatic aid given) were excluded to avoid double counting of incidents.
- Property use 400 to 464:

Property Use	Description
460	Dormitory-type residence, other
462	Sorority house, fraternity house
464	Barracks, dormitory

and,

- Structure type:
  - 1 - Enclosed building;
  - 2 - Fixed portable or mobile structure; and
  - Structure type not specified (null entry).

The USFA cause hierarchy was used to determine the cause of university housing fire incidents:[16] http://www.usfa.fema.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm

To request additional information or to comment on this report, visit http://www.usfa.fema.gov/applications/feedback/index.jsp

Notes:

[1] National estimates are based on 2005-2007 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's) annual surveys of fire loss. Fires are rounded to the nearest 100, deaths to the nearest 5, injuries to the nearest 25, and loss to the nearest $million.

[2] University housing consists of college and university residential buildings that include dormitories and barracks (a combined category), sorority houses, and fraternity houses.

[3] In the National Fire Incident Reporting System (NFIRS), version 5.0, a structure is a constructed item of which a building is one type. In previous versions of NFIRS, the term "residential structure" commonly referred to buildings where people live. To coincide with this concept, the definition of a residential structure fire for NFIRS 5.0 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.

[4] "News from CPSC, U.S. Consumer Product Safety Commission: Increase in College Dorm Fire Prompts Officials to Issue Warning," cpsc.gov, August 21, 2007. http://www.cpsc.gov/cpscpub/prerel/prhtml07/07279.html (accessed June 10, 2009).

[5] NFIRS distinguishes between "content" and "property" loss. Content loss includes loss to the contents of a structure due to damage by fire, smoke, water, and overhaul. Property loss includes losses to the structure itself or to the property itself. Total loss is the sum of the content loss and the property loss. For confined fires, the expectation is that the fire did not spread beyond the container (or rubbish for incident type 118) and hence, there was no property damage (damage to the structure itself) from the flames. There could be, however, property damage as a result of smoke, water, and overhaul.

[6] The average fire death and fire injury loss rates computed from the national estimates above will not agree with average fire death and fire injury loss rates computed from NFIRS data alone. The fire death rate computed from national estimates would be (1000*(5/3,800)) = 1.3 deaths per 1,000 university housing fires and the fire injury rate would be (1000*(50/3,800)) =13.2 injuries per 1,000 university housing fires.

[7] For the purposes of this report, the time of the fire alarm is used as an approximation for the general time the fire started. However, in NFIRS, it is the time the fire was reported to the fire department.

[8] These causes are: heating, cooking, electrical malfunction, appliances, other equipment, and equipment misoperation. Other causes may also have had equipment involved.

[9] Percentages cited in the text may not add to 100 due to rounding.

[10] In confined fires, the entry "smoke alarm did not alert occupants" can mean: no smoke alarm was present, the smoke alarm was present but did not operate, or the smoke alarm was present and operated but the occupant was already aware of the fire.

[11] As confined fires codes are designed to capture fires contained to noncombustible containers, it is not recommended to code a fire incident as a small, low- or no-loss confined fire incident if an automatic extinguishing system (AES) operated and contained the fire as a result. The preferred method is to code the fire as a standard fire incident with fire spread confined to the object of origin and provide the relevant information on AES presence and operation.

[12] Lisa Backus, "CCSU athletes arrested for popcorn fire prank in dorm," bristolpress.com, May 12, 2009. http://www.bristolpress.com/articles/2009/05/12/news/doc4a08a5386398f485964256.prt (accessed May 28, 2009).

[13] "Fire breaks out at NIU frat house," chicagobreakingnews.com, May 6, 2009. http://www.chicagobreakingnews.com/2009/05/fire-breaks-out-at-niu-frat-house.html (accessed May 28, 2009).

[14] Scott Lawrence, "Investigators determine cause of LU residence hall fire," kfdm.com, April 23, 2009. http://www.kfdm.com/common/printer/view.php?db=kfdm&id=31329 (accessed May 28, 2009).

[15] Mark White, "Fire damages University of the Cumberlands building, Quick response by local firefighters contain blaze," thenewsjournal.net, May 12, 2009. http://www.thenewsjournal.net/details.cfm?id=2413 (accessed May 28, 2009).

[16] USFA's cause hierarchy is designed for structure fires of which buildings are a subset.