Residential Building Fires Involving Individuals with Physical Disabilities

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.

Findings

- An estimated 700 residential building fires involving individuals with physical disabilities are reported to U.S. fire departments each year and cause an estimated 160 deaths, 200 injuries, and $26 million in total loss.
- Cooking (22 percent) is the leading cause of residential building fires where a physical disability is reported as a human factor contributing to ignition.
- Sixty-five percent of residential building fires involving people with physical disabilities are limited to the object or room of origin.
- The cooking area or kitchen is the primary area of origin for residential building fires involving individuals with physical disabilities (38 percent).
- Residential building fires involving people with physical disabilities are more prevalent in January (12 percent) and December (10 percent).

From 2007 to 2009, an estimated 700 residential building fires involving individuals with disabilities were reported by U.S. fire departments annually. These fires caused an estimated 160 deaths, 200 injuries, and $26 million dollars in property damage.[1,2,3] A companion topical report on residential building fires involving individuals with mental disabilities is also available, *Residential Building Fires Involving Individuals with Mental Disabilities*, Vol. 12, Issue 5.[4]

When a fire breaks out, escaping a building safely can be challenging. Many people can become disoriented and panicked because of dense smoke in the home or the presence of flames. People with disabilities are confronted with additional challenges when trying to evacuate a building. If an individual is bedridden, uses a wheelchair, or uses another medical apparatus to maneuver, such as crutches, it can be very difficult to navigate an escape route. As well, a physical disability may affect an individual's capability to act quickly to prevent a potential fire.

To help individuals with disabilities, the Americans with Disabilities Act (ADA) provides that certain multistory buildings must contain areas of rescue assistance (ARA). These areas are where people with disabilities can go to await assistance or further instruction during an emergency situation.[5] The guidelines in the ADA dictate in which buildings ARAs are required as well as when ARAs do not need to be provided. In these areas, individuals with disabilities must be able to communicate with people outside the building both audibly and visually.[6] If the individual, however, resides in a building that does not contain ARAs, evacuation is left up to the individual, other people with whom they live, or neighbors until the fire department can arrive.

This report focuses on the characteristics of residential building fires where a physical disability, as reported to the National Fire Incident Reporting System (NFIRS) from 2007 to 2009, contributed to the ignition of the fire. It is important to note that this analysis does not address those fire casualties where a physical disability contributed to the injury.

The NFIRS data are used for the analyses presented throughout the report. For the purpose of the report, the term "residential building fires involving individuals with physical disabilities" is synonymous with "fires involving individuals with physical disabilities." "Fires involving individuals with physical disabilities" are used throughout the body of this report; the findings, tables, charts, headings, and footnotes reflect the full category "residential building fires involving individuals with physical disabilities."

Type of Fire

Building fires are divided into two classes of severity in NFIRS: "confined fires," which are those fires confined to certain types of equipment or objects, and "nonconfined fires," which are not. Confined building fires are small fire incidents that are limited in extent, staying within pots

or fireplaces or certain other noncombustible containers.[7] Confined fires rarely result in serious injury or large content losses, and are expected to have no significant accompanying property losses due to flame damage.[8]

Nonconfined fires account for 84 percent of fires involving individuals with physical disabilities (Table 1). Cooking fires account for 92 percent of the confined fires.

Table 1. Residential Building Fires Involving Individuals with Physical Disabilities by Type of Incident (2007–2009)

Incident Type	Percent of Fires
Nonconfined fires	84.0
Building fires	76.9
Fire in mobile home used as a fixed residence	6.1
Fires in structures other than a building	0.6
Fire in motor home, camper, recreational vehicle	0.3
Fire in mobile property used as a fixed structure, other	0.1
Confined fires	16.0
Cooking fire, confined to container	14.7
Trash or rubbish fire, contained	0.8
Chimney or flue fire, confined to chimney or flue	0.4
Total	100.0

Source: NFIRS 5.0.
Notes: 1) Total may not add to 100 percent due to rounding.
2) Prior to 2008, fires in structures other than a building are included, as previous analyses have shown that fires coded as structures other than a building were often building fires and the codes used interchangeably.

NFIRS allows abbreviated reporting for confined fires and many reporting details of these fires are not required nor reported. In the case of confined fires involving individuals with physical disabilities, however, many of the details of these fires are included. The subsequent analysis in this report, therefore, includes all fires involving individuals with physical disabilities and does not distinguish between confined and nonconfined fires.

Type of Property

Residential buildings are divided into three major property types: one- and two-family buildings, multifamily buildings, and other. One- and two-family residential buildings include detached single-family residences, manufactured homes, mobile homes not in transit, and duplexes. Multifamily residential buildings include apartments, condos, and townhouses. Other residential buildings include all other types of residential buildings, such as hotels or motels, long-term care facilities, dormitories, and sorority or fraternity housing.

One- and two-family residential buildings account for the largest portion (63 percent) of residential fires involving individuals with physical disabilities as reported by NFIRS (Table 2). Multifamily buildings were involved in 30 percent of fires involving people with physical disabilities.

Table 2. Residential Building Fires Involving Individuals with Physical Disabilities by Property Type (2007–2009)

Property Type	Percent of Fires
One- and Two-Family	63.0
Multifamily	30.1
Other	6.9
Total	100.0

Source: NFIRS 5.0.

Loss Measures

Table 3 presents losses, averaged over this 3-year period, of reported residential fires where "physically disabled" was identified as a human factor contributing to the ignition of the fire.[9] While fires involving individuals with physical disabilities are similar in the dollar loss per fire to fires involving individuals with mental disabilities, they are much more injurious. (See *Residential Building Fires Involving Individuals with Mental Disabilities*, Vol. 12, Issue 5.)

Table 3. Loss Measures for Residential Building Fires Involving Individuals with Physical Disabilities (3-year average, 2007–2009)

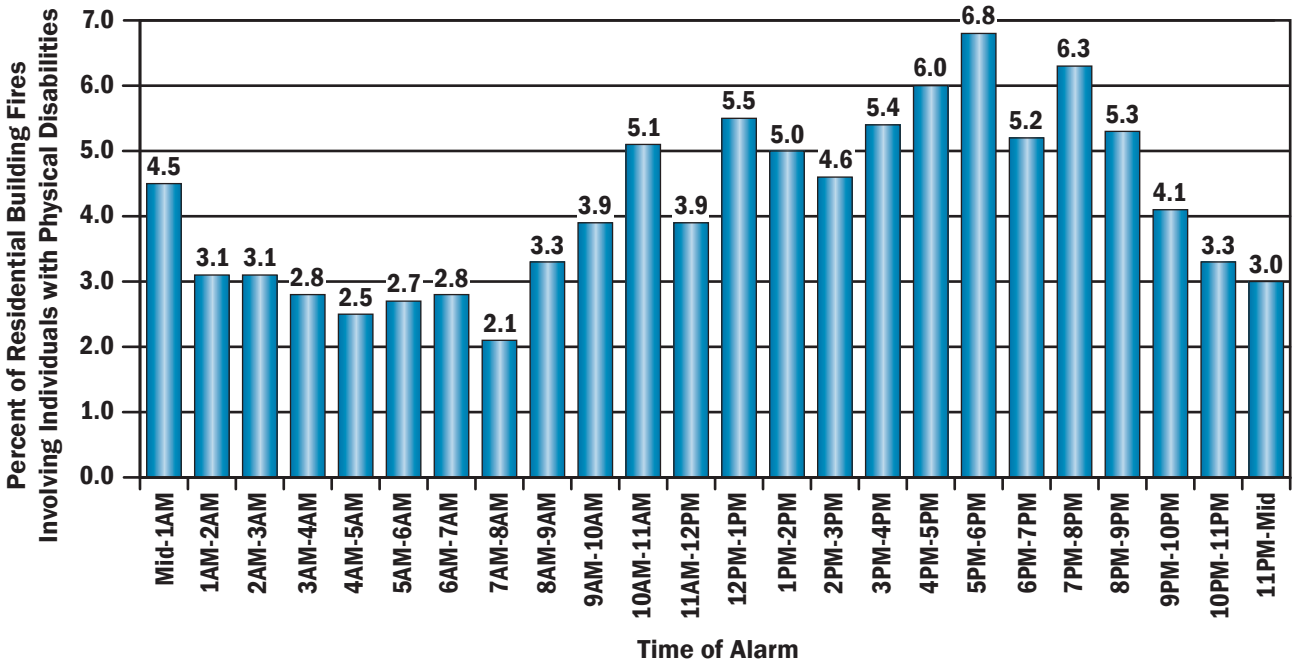
Measure	Loss for Fires
Average Loss:	
Fatalities/1,000 fires	188.2
Injuries/1,000 fires	232.9
Dollar loss/fire	$32,060

Source: NFIRS 5.0.
Note: 1) 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.
2) Dollar loss is converted to $2009.

When Residential Building Fires Involving Individuals with Physical Disabilities Occur

As shown in Figure 1, fires involving individuals with physical disabilities show a tendency to occur more frequently in the late afternoon to early evening hours. Cooking fires, the leading cause of fires involving individuals with physical disabilities (Figure 3), are typically prevalent during this time. Between 2007 and 2009, reported residential fires that involved people with physical disabilities peaked between 5 and 6 p.m., with a second peak between 7 and 8 p.m. Fire incidence was at its lowest during the early and midmorning hours between 3 and 8 a.m.[10]

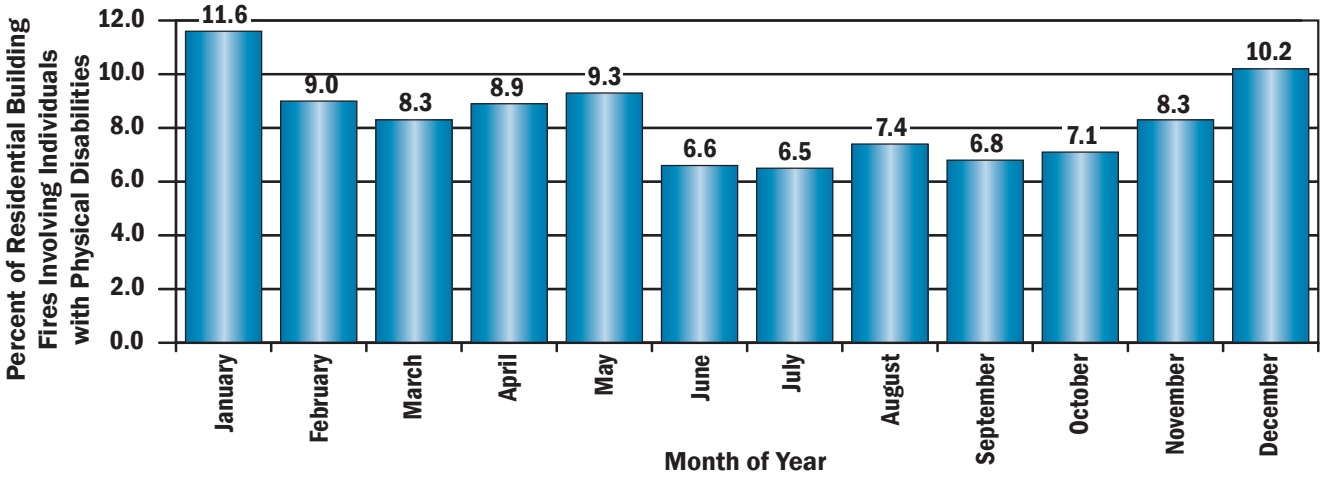
Figure 1. Residential Building Fires Involving Individuals with Physical Disabilities by Time of Alarm (2007–2009)



Source: NFIRS 5.0.

Figure 2 illustrates the residential building fire profile, by month, for fires involving individuals with physical disabilities. These fires peak in the winter months of December (10 percent) and January (12 percent). The increase in fires during January is partially a result of cooking and smoking-related fires. The lowest numbers of fire incidents occur in June and July.

Figure 2. Residential Building Fires Involving Individuals with Physical Disabilities by Month (2007–2009)

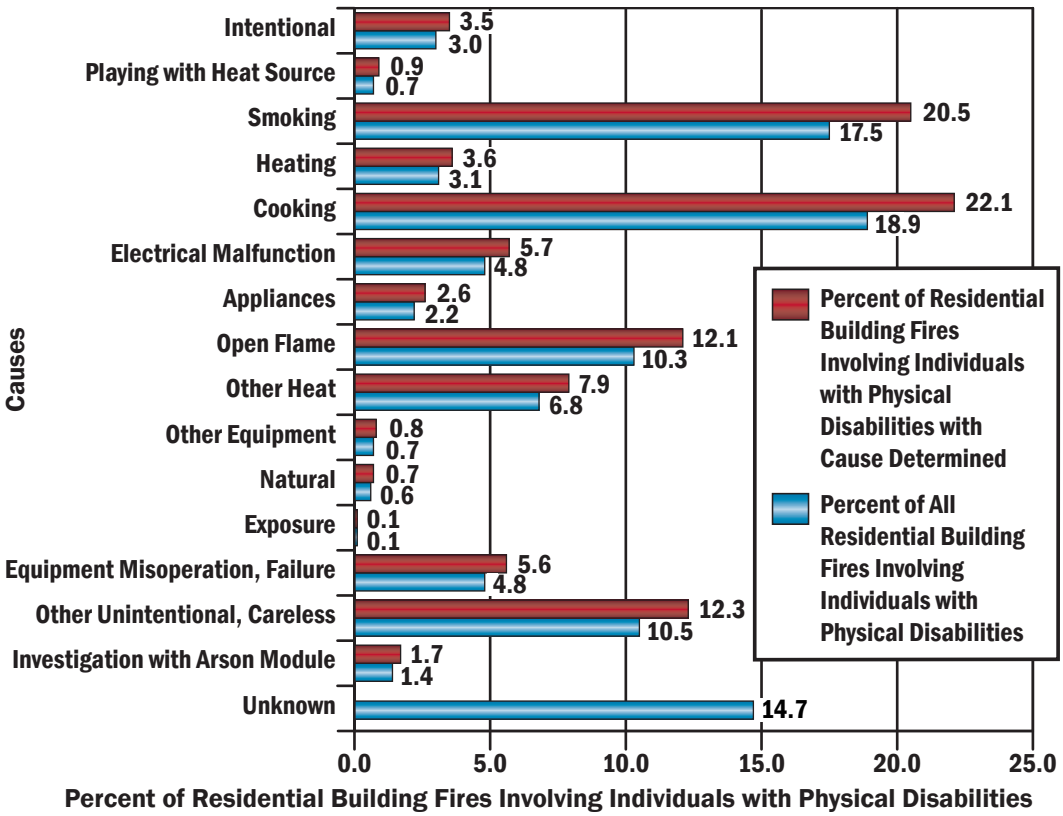


Source: NFIRS 5.0.

Causes of Residential Building Fires Involving Individuals with Physical Disabilities

Forty-three percent of fires involving individuals with physical disabilities are the result of cooking fires (22 percent) and smoking-related fires (21 percent) as shown in Figure 3. The next three leading causes of these fires combined account for an additional 32 percent: other unintentional, careless actions (12 percent), open flames (12 percent), and other heat (8 percent).[11]

Figure 3. Residential Building Fires Involving Individuals with Physical Disabilities by Cause (2007–2009)



Source: NFIRS 5.0.

Note: Causes are listed in order of the U.S. Fire Administration (USFA) Cause Hierarchy for ease of comparison of fire causes across different aspects of the fire problem. Fires are assigned to 1 of 16 cause groupings using a hierarchy of definitions, approximately as shown in the chart above. A fire is included in the highest category into which it fits. If it does not fit the top category, then the second one is considered, and if not that one, the third, and so on. For example, if the fire is judged to be intentionally set and a match was used to ignite it, it is classified as intentional and not open flame because intentional is higher in the hierarchy.

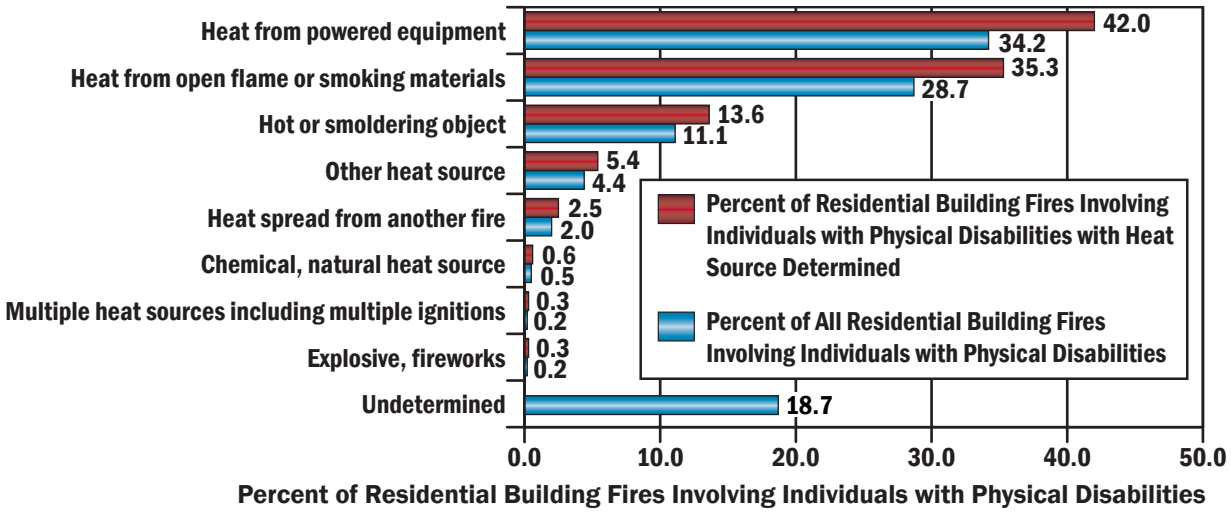
Heat Source in Residential Building Fires Involving Individuals with Physical Disabilities

Figure 4 shows sources of heat categories in fires involving individuals with physical disabilities. The "heat from powered equipment" category accounts for 42 percent of fires involving people with physical disabilities. Within this category, radiated or conducted heat from operating equipment accounts for 18 percent and heat from unspecified powered equipment accounts for 14 percent of fires involving individuals with physical disabilities.

The "heat from open flame or smoking materials" category accounts for 35 percent of all fires involving individuals with physical disabilities. Cigarettes account for 20 percent, and lighters, candles, and heat from other open flames account for 4 percent each.

The heat source was coded as "undetermined" in 19 percent of all fires involving people with physical disabilities.

Figure 4. Heat Source for Residential Building Fires Involving Individuals with Physical Disabilities (2007–2009)



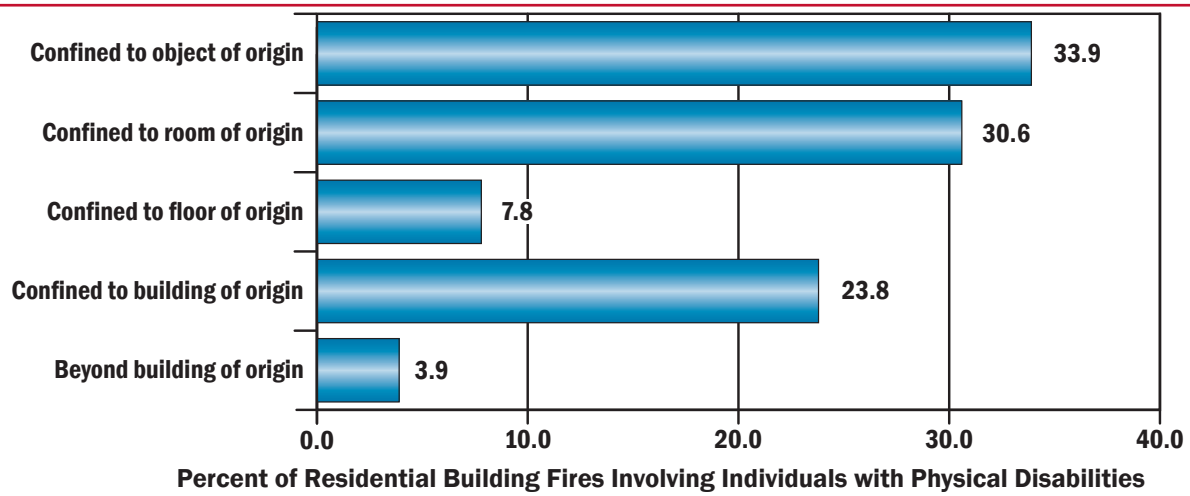
Source: NFIRS 5.0.

Fire Spread in Residential Building Fires Involving Individuals with Physical Disabilities

Fires involving individuals with physical disabilities are largely confined to the room of origin (65 percent), either confined to the object of origin (34 percent), or spreading beyond the object but still confined to the room of origin (31 percent). This is not surprising since the leading cause of fires involving people with physical disabilities is cooking; 96 percent of cooking fires are confined to the object or room of origin, the kitchen.

Ninety-six percent of fires involving people with physical disabilities never extend beyond the building of origin (Figure 5).

Figure 5. Extent of Residential Building Fire Spread in Fires Involving Individuals with Physical Disabilities (2007–2009)



Source: NFIRS 5.0.

Where Residential Building Fires Involving Individuals with Physical Disabilities Start (Area of Origin)

As shown in Table 4, kitchens are the most common area of origin for fires involving individuals with physical disabilities (38 percent). Bedrooms account for an additional 24 percent of the fires. The next three leading areas of origin account for an additional 24 percent: common rooms including dens, family rooms, living rooms, and lounges (14 percent), other functional areas (7 percent), and bathrooms, checkrooms, and lavatories (3 percent).

Table 4. Leading Areas of Fire Origin in Residential Building Fires Involving Individuals with Physical Disabilities (2007–2009)

Areas of Fire Origin	Percent of Fires (Unknowns Apportioned)
Cooking area, kitchen	37.6
Bedrooms	23.5
Common room, den, family room, living room, lounge	13.8
Function areas, other	6.9
Bathroom, checkroom, lavatory	3.1

Source: NFIRS 5.0.

Factors Contributing to Ignition in Residential Building Fires Involving Individuals with Physical Disabilities

Table 5 shows the categories of factors contributing to ignition in fires involving individuals with physical disabilities. By far, the leading category for fires involving people with physical disabilities is "misuse of material or product" (62 percent). Heat source too close to combustibles (24 percent of all fires involving individuals with physical disabilities), abandoned or discarded materials or products (17 percent), misuse of materials or products, other (16 percent) and playing with heat source (2 percent) account for the majority of fires in this category.

The "operational deficiency" category is the second most common contributing factor in fires involving individuals with physical disabilities (23 percent). Equipment unattended (11 percent), accidentally turned on, not turned off (4 percent), failure to clean (2 percent), and equipment not operated properly (2 percent) comprise the majority of fires in this category.

The third and fourth most common categories of factors contributing to the ignition of fires involving people with physical disabilities are "other factors contributing to ignition" (9 percent) and "electrical failure, malfunction" (8 percent).

Table 5. Factors Contributing to Ignition for Residential Building Fires Involving Individuals with Physical Disabilities by Major Category (Where Factors Contributing to Ignition Specified, 2007–2009)

Factors Contributing to Ignition Category	Percent of Fires
Misuse of material or product	62.3
Operational deficiency	22.7
Other factors contributing to ignition	9.3
Electrical failure, malfunction	7.7
Mechanical failure, malfunction	2.7
Fire spread or control	1.8
Design, manufacture, installation deficiency	1.0
Natural condition	0.4

Source: NFIRS 5.0.

Notes: 1) Includes only incidents where factors that contributed to the ignition of the fire were specified.
2) Multiple factors contributing to fire ignition may be noted for each incident; total will exceed 100 percent.

Alerting/Suppression Systems in Residential Building Fires Involving Individuals with Physical Disabilities

Smoke Alarm Data

Smoke alarm data presented in Tables 6 and 7 are the raw counts from the NFIRS data set and are not scaled to national estimates of smoke alarms in fires involving individuals with physical disabilities. In addition, NFIRS does not allow for the determination of the type of smoke alarm—that is, if the smoke alarm was photoelectric or ionization, or the location of the smoke alarm with respect to the area of fire origin.

Overall, smoke alarms were present in 51 percent of fires involving individuals with physical disabilities. In 17 percent of fires involving people with physical disabilities, there were no smoke alarms present and in 22 percent of fires, firefighters were unable to determine if a smoke alarm was present (Table 6).

Table 6. NFIRS Smoke Alarm Presence in Fires Involving Individuals with Physical Disabilities (NFIRS, 2007–2009)

Presence of Smoke Alarms	Fires	
	Count	Percent
Present	679	50.5
None present	229	17.0
Undetermined	289	21.5
Null/Blank	147	10.9
Total Incidents	1,344	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 smoke alarms in fires involving individuals with physical disabilities. They are presented for informational purposes. Total will not add to 100 percent due to rounding.

Smoke Alarms in Occupied Housing

Smoke alarms provide early warning in the event of a fire, giving occupants the opportunity to escape. Because the effectiveness of smoke alarms is measured by the building occupants' hearing and responding to the alarms, the analysis of effectiveness (or performance) of smoke alarms is thus limited to occupied housing.[12]

Smoke alarms were reported as present in 57 percent of fires involving individuals with physical disabilities in occupied housing (Table 7). Smoke alarms are known to have operated in 36 percent of fires involving people with physical disabilities in occupied housing and were known to be absent in 18 percent. Firefighters were unable to determine if a smoke alarm was present in another 24 percent of these fires.

When operational status is considered for fires involving individuals with physical disabilities in occupied housing, the percentage of smoke alarms reported as present (57 percent) consists of:

- smoke alarms present and operated—36 percent;
- present, but did not operate—11 percent (fire too small, 3 percent; alarm did not operate, 8 percent); and
- present, but operational status unknown—10 percent.

When the subset of incidents where smoke alarms were reported as present is analyzed separately, smoke alarms were reported to have operated in 63 percent of the incidents. The alarms did not operate, however, in 19 percent of the incidents (in 14 percent of the incidents, the alarm failed to operate; in 5 percent, the fire was too small to activate the alarm). The operational status of the alarm was undetermined in an additional 18 percent of the incidents.

Table 7. NFIRS Smoke Alarm Data for Residential Building Fires Involving Individuals with Physical Disabilities in Occupied Housing (NFIRS, 2007–2009)

Presence of Smoke Alarms	Smoke Alarm Operational Status	Smoke Alarm Effectiveness	Count	Percent
Present	Fire too small to activate smoke alarm		33	2.9
	Smoke alarm operated	Smoke alarm alerted occupants, occupants responded	304	26.5
		Smoke alarm alerted occupants, occupants failed to respond	51	4.4
		No occupants	6	0.5
		Smoke alarm failed to alert occupants	13	1.1
		Undetermined	42	3.7
	Smoke alarm failed to operate		91	7.9
	Undetermined		118	10.3
None present			209	18.2
Undetermined			280	24.4
Total Incidents			1,147	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 smoke alarms in residential building fires involving individuals with physical disabilities. They are presented for informational purposes. Total will not add to 100 percent due to rounding.

Automatic Extinguishment System Data

Overall, full or partial automatic extinguishing systems (AESs), mainly sprinklers, were present in 8 percent of fires involving individuals with physical disabilities (Table 8). The small number of suppression equipment (sprinklers) in these fires is not unexpected as sprinklers are largely absent nationwide in residential buildings. Note that the data presented in Table 8 are the raw counts from the NFIRS data set and are not scaled to national estimates of AES in fires involving people with physical disabilities.

Table 8. NFIRS Automatic Extinguishing System Presence in Residential Building Fires Involving Individuals with Physical Disabilities (2007–2009)

Presence of Automatic Extinguishing Systems	Fires	
	Count	Percent
AES present	107	8.0
Partial system present	2	0.1
AES not present	1,027	76.4
Unknown	61	4.5
Null/Blank	147	10.9
Total Incidents	1,344	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 residential building fires involving individuals with physical disabilities. They are presented for informational purposes. Total will not add to 100 percent due to rounding.

NFIRS Data Specifications for Residential Building Fires Involving Individuals with Physical Disabilities

Data for this report were extracted from the NFIRS annual Public Data Release (PDR) files for 2007, 2008, and 2009. Only version 5.0 data were extracted.

Residential building fires involving individuals with physical disabilities are defined as:

- Aid Types 3 (mutual aid given) and 4 (automatic aid given) are excluded to avoid double counting of incidents.

- 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

  Incident Type 112 is included prior to 2008 as previous analyses have shown that Incident Types 111 and 112 were used interchangeably. As of 2008 and 2009, Incident Type 112 is excluded.

  Note that Incident Types 113 to 118 do not specify if the structure is a building.

- Property use 400-464 is included to specify residential buildings:

Property Use	Description
400	Residential, other
419	One- or two-family dwelling
429	Multifamily dwelling
439	Boarding/Rooming house, residential hotels
449	Hotel/Motel, commercial
459	Residential board and care
460	Dormitory-type residence, other
462	Sorority house, fraternity house
464	Barracks, dormitory

- Structure Type:
  - For Incident Types 113–118:
    - 1—Enclosed building,
    - 2—Fixed portable or mobile structure, and
    - Structure Type not specified (null entry).
  - For Incident Types 111, 112, and 120–123:
    - 1—Enclosed building, and
    - 2—Fixed portable or mobile structure.
- Human Factor Contributing to Ignition Code 5 "physically disabled" was used to define fires involving individuals with physical disabilities.

The analyses contained in this report reflect the current methodologies used by the U.S. Fire Administration (USFA). The USFA is committed to providing the best and most current information on the United States fire problem, continually examining its data and methodology to fulfill this goal. Because of this commitment, data collection strategies and methodological changes are possible and do occur. As a result, analyses and estimates of the fire problem may change slightly over time. Previous analyses and estimates on specific issues (or similar issues) may have used different methodologies or data definitions and may not be directly comparable to the current ones.

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 2007–2009 native version 5.0 data from the National Fire Incident Reporting System (NFIRS), residential structure fire loss estimates from the National Fire Protection Association's (NFPA's) annual surveys of fire loss, and the U.S. Fire Administration's (USFA's) residential building fire loss estimates. Fires are rounded to the nearest 100, deaths to the nearest 5, injuries to the nearest 25, and loss to the nearest $million.

[2] In 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. Confined fire incidents that have a residential property use, but do not have a structure type specified are presumed to be buildings. Nonconfined fire incidents without a structure type specified are considered to be invalid incidents (structure type is a required field) and are not included.

[3] Residential buildings include, but are not limited to, one- or two-family dwellings, multifamily dwellings, boarding houses or residential hotels, commercial hotels, college dormitories, and sorority/fraternity houses.

[4] In approximately 8 percent of residential building fires where a physical disability was noted as a human factor contributing to ignition of the fire, a mental disability was also noted.

[5] Mark A. Brown, "Fire Suppression Operations in Buildings Equipped with an "Area of Rescue Assistance," Concord Department of Fire and Life Safety, December 1, 2005. http://www.ci.concord.nc.us/LinkClick.aspx?fileticket=TfBCh6hZMAQ%3D&tabid=166&mid=540 (accessed December 3, 2010).

[6] "Rescue Assistance Made Easy," securitymagazine.com, June 11, 2003. http://www.securitymagazine.com/Articles/Technologies/f505c1ad744d8010VgnVCM100000f932a8c0____ (accessed December 3, 2010).

[7] In NFIRS, confined fires are defined by Incident Type codes 113 to 118.

[8] 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.

[9] The average fire death and fire injury loss rates computed from the national estimates 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 for people with physical disabilities would be (1,000*(160/700)) = 228.6 deaths per 1,000 residential building fires involving individuals with physical disabilities. The fire injury rate would be (1,000*(200/700)) = 285.7 injuries per 1,000 residential building fires involving individuals with physical disabilities.

[10] 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.

[11] The USFA cause hierarchy was used to determine the cause of fire incidents involving individuals with physical disabilities: http://www.usfa.dhs.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm.

[12] Analyses of smoke alarm performance and effectiveness in *unoccupied* residential buildings have shown a large number of "undetermined" entries. These undetermined entries are wholly logical if no occupants were present to acknowledge or respond to the alarms. The "undetermined" entries, however, muddy analyses of the data; analyses of only occupied residential buildings helps address this analytic problem.