U.S. Fire Administration/National Fire Data Center

Data Sources and Methodology Documentation

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FEMA

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DATA SOURCES

The U.S. Fire Administration's (USFA's) data analyses are based primarily on the National Fire Incident Reporting System (NFIRS) data, but use other sources as well. Summary numbers for fires, deaths, injuries and dollar loss are from the National Fire Protection Association's (NFPA's) annual survey of fire departments.[1] Other data sources used by USFA include 2010 National Center for Health Statistics (NCHS) mortality data[2] as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program, population estimates from the U.S. Census Bureau, inflation adjustments from the Bureau of Labor Statistics' consumer price index, and state statistics from state fire marshals' offices or their equivalents are also used. Because the NCHS mortality data are based on a census or enumeration of deaths based on death certificates rather than an estimate, it is used as the primary source for the computation of fire death rates and relative risk. The most current year available for the NCHS mortality data is 2010.[3] Please note that for consistency, national trend data are based on the NFPA survey estimates, not the NCHS mortality data.

The USFA gratefully acknowledges the use of the data and information provided by these groups. Data sources are cited for each graph and table.

National Fire Incident Reporting System

The NFIRS was established in 1975 as one of the first programs of the National Fire Prevention and Control Administration, which later became the USFA. The basic concept of NFIRS has not changed since the system's inception. All states and all fire departments within them have been invited to participate on a voluntary basis. Participating fire departments collect a common core of information on an incident and any casualties that ensue by using a common set of definitions. In a very few departments, the data may be written by hand on paper forms; however, the majority of the data are collected electronically through third party software, the NFIRS data entry tool, or the reporting department's own system. Local agencies forward the completed NFIRS modules to the state agency responsible for NFIRS data. The state agency combines the information with data from other fire departments into a statewide database and then transmits the data to the National Fire Data Center at the USFA. Data on individual incidents and casualties are preserved incident by incident at local, state and national levels. Once limited to fire incidents only, NFIRS now encompasses all incidents to which the fire department responds: fire, Emergency Medical Services (EMS), hazardous materials (hazmat), and the like.

1 The NFPA summary numbers are used for the overall U.S. fire losses; fire losses from vehicle, outside and other fires; and as the basis for estimates of residential and nonresidential building fires. The alternative approach for these summary numbers is to use the relative percentage of fires (or other loss measures) from NFIRS and scale up (multiply by) the NFPA estimate of total fires. The results would be somewhat different from those using the NFPA subtotals. These differences are discussed in the section Differences Between NFIRS Data and NFPA Survey Data at the end of this document. Better estimates of fire-loss measures from NFIRS will not be available until a more robust method of estimation is developed.

2 The NCHS data provide additional detail not available from the NFPA survey: state of fire death occurrence, age, gender and race.

3 The 2011 NCHS data were not available at the time the analyses were undertaken; the 2010 NCHS mortality data were released in 2012. As a result, the fire incident and fire injury analyses from NFIRS focus on 2011 while the fire death analyses are from 2010. As well, 10-year trends for the NCHS data are from 2001 to 2010 rather than the 2002 to 2011 trend data from NFPA and NFIRS.

From an initial six states in 1976, NFIRS has grown in both participation and use. Over the life of the system, all 50 states, the District of Columbia, and more than 40 major metropolitan areas have reported to NFIRS. As well, more than 30,000 fire departments have been assigned participating NFIRS fire department identification (FDID) numbers by their states. Approximately 1 million fire incident records and 21 million nonfire incident records are added to the database each year. NFIRS is the world's largest collection of incidents to which fire departments respond.

Between 1985 and 1999, the level of participation remained relatively constant: A few states came in or left the system each year, and at least 39 states reported to NFIRS. Most years also included participation from the District of Columbia. The number of fire departments participating within the states remained relatively constant as well, with a slight dip in participation during the system migration from version 4.1 to 5.0 in 1999. In 2000, the number of states increased to 43, and fire department participation began to bounce back from the version 5.0 transition low. Since 2000, state and fire department participation has been steadily increasing. In 2003, NFIRS reached a milestone with participation by all 50 states. The following year, NFIRS achieved another significant goal: NFIRS not only achieved the national goal of 100 percent state participation, including the District of Columbia, but also for the first time, the Native American Tribal Authorities submitted data.

NFIRS continues to grow and mature. As of 2007, a new level of participation had been achieved: all 50 states, the District of Columbia, Native American Tribal Authorities, Northern Mariana Islands, and Puerto Rico all participated in NFIRS for a total of 54 state, district, tribal authority, and commonwealth entities (Table 1). However, the Mariana Islands and Puerto Rico are no longer reporting incident data to NFIRS. Fire departments reporting fire incidents grew to 20,680 in 2011 (Figure 1). Across participating entities, 69 percent of U.S. fire departments reported fire incidents to NFIRS in 2011.[4] With over two-thirds of all fire departments nationwide reporting fire incidents to NFIRS 5.0, the reporting departments represent a very large dataset that enables USFA to make reasonable estimates of various facets of the fire problem. Although some states do require their departments to participate in the state system, participation in NFIRS is voluntary. Additionally, if a fire department is a recipient of a Fire Act Grant, participation is required[5].

Table 1. States Reporting Fire Incidents to NFIRS (2002–2011)

State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Alabama	X	X	X	X	X	X	X	X	X	X
Alaska	X	X	X	X	X	X	X	X	X	X
Arizona	X	X	X	X	X	X	X	X	X	X
Arkansas	X	X	X	X	X	X	X	X	X	X
California	X	X	X	X	X	X	X	X	X	X
Colorado	X	X	X	X	X	X	X	X	X	X
Connecticut	X	X	X	X	X	X	X	X	X	X
Delaware	X	X	X	X	X	X	X	X	X	X
District of Columbia			X	X		X		X	X	X
Florida	X	X	X	X	X	X	X	X	X	X
Georgia	X	X	X	X	X	X	X	X	X	X
Hawaii	X	X	X	X	X	X	X	X	X	X
Idaho	X	X	X	X	X	X	X	X	X	X
Illinois	X	X	X	X	X	X	X	X	X	X

4 For 2011, NFPA estimated that there were 30,145 fire departments in the U.S. Source: NFPA, U.S. Fire Department Profile Through 2011, http://www.nfpa.org/assets/files//PDF/OS.FDProfile.pdf, October 2012.

5 From the Assistance to Firefighters Grant Guidance and Application Kit (June 2012), if the applicant is a fire department, the department must agree to provide information, through established reporting channels, to NFIRS for the period covered by the assistance. If a fire department does not currently participate in the incident reporting system and does not have the capacity to report at the time of the award, the department must agree to provide information to the system for a 12-month period that begins as soon as the department develops the capacity to report. See http://www.fema.gov/library/viewRecord.do?id=6007 (fg_2012_afg_program_guidance.pdf).

Table 1. States Reporting Fire Incidents to NFIRS (2002–2011) – continued

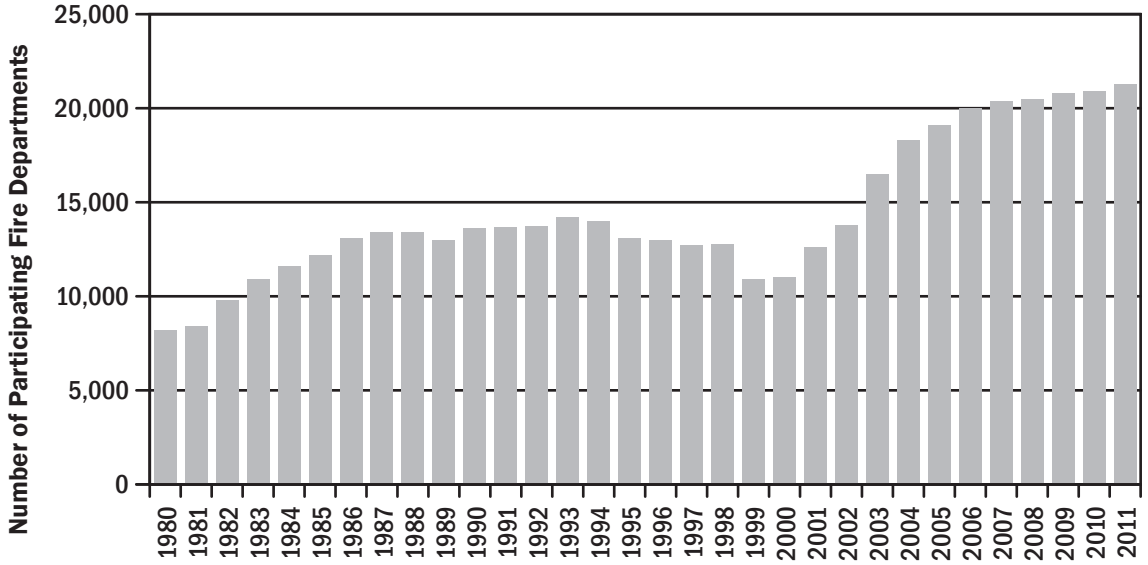
State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Indiana	X	X	X	X	X	X	X	X	X	X
Iowa	X	X	X	X	X	X	X	X	X	X
Kansas	X	X	X	X	X	X	X	X	X	X
Kentucky	X	X	X	X	X	X	X	X	X	X
Louisiana	X	X	X	X	X	X	X	X	X	X
Maine	X	X	X	X	X	X	X	X	X	X
Maryland	X	X	X	X	X	X	X	X	X	X
Massachusetts	X	X	X	X	X	X	X	X	X	X
Michigan	X	X	X	X	X	X	X	X	X	X
Minnesota	X	X	X	X	X	X	X	X	X	X
Mississippi	X	X	X	X	X	X	X	X	X	X
Missouri	X	X	X	X	X	X	X	X	X	X
Montana	X	X	X	X	X	X	X	X	X	X
Nebraska	X	X	X	X	X	X	X	X	X	X
Nevada	X	X	X	X	X	X	X	X	X	X
New Hampshire	X	X	X	X	X	X	X	X	X	X
New Jersey	X	X	X	X	X	X	X	X	X	X
New Mexico	X	X	X	X	X	X	X	X	X	X
New York	X	X	X	X	X	X	X	X	X	X
North Carolina	X	X	X	X	X	X	X	X	X	X
North Dakota	X	X	X	X	X	X	X	X	X	X
Ohio	X	X	X	X	X	X	X	X	X	X
Oklahoma	X	X	X	X	X	X	X	X	X	X
Oregon	X	X	X	X	X	X	X	X	X	X
Pennsylvania	X	X	X	X	X	X	X	X	X	X
Rhode Island		X	X		X	X	X	X	X	X
South Carolina	X	X	X	X	X	X	X	X	X	X
South Dakota	X	X	X	X	X	X	X	X	X	X
Tennessee	X	X	X	X	X	X	X	X	X	X
Texas	X	X	X	X	X	X	X	X	X	X
Utah	X	X	X	X	X	X	X	X	X	X
Vermont	X	X	X	X	X	X	X	X	X	X
Virginia	X	X	X	X	X	X	X	X	X	X
Washington	X	X	X	X	X	X	X	X	X	X
West Virginia	X	X	X	X	X	X	X	X	X	X
Wisconsin	X	X	X	X	X	X	X	X	X	X
Wyoming	X	X	X	X	X	X	X	X	X	X
Native American			X	X	X	X	X	X	X	X
Northern Mariana Islands					X	X				
Puerto Rico				X	X	X	*	*		
Total	49	50	52	52	53	54	51	52	52	52

Source: NFIRS.

Note: Includes fire incidents submitted in both NFIRS versions 4.1 and 5.0 for 2002-2008. Beginning in 2009, includes only fire incidents submitted in NFIRS version 5.0.

* Puerto Rico submitted fire incident data to NFIRS in 2008-2009, but the data were excluded from all fire data analyses due to data quality issues.

Figure 1. NFIRS Fire Department Participation (1980–2011, fire incidents only)



Source: NFIRS.
Note: 1999-2008 includes participation from NFIRS 4.1 and NFIRS 5.0.; 2009 and later includes participation only from NFIRS 5.0.

Table 2. Fire Departments Reporting Fire Incidents to NFIRS in 2011

State	No. of Fire Departments in State	No. of Reporting Fire Departments (NFIRS 5.0)	Percent of Reporting Fire Departments (NFIRS 5.0)
Alabama	1,230	324	26%
Alaska	235	111	47%
Arizona	314	80	25%
Arkansas	976	656	67%
California	1,105	453	41%
Colorado	385	249	65%
Connecticut	260	219	84%
Delaware	61	59	97%
District of Columbia	1	1	100%
Florida	573	437	76%
Georgia	626	311	50%
Hawaii	6	4	67%
Idaho	246	150	61%
Illinois	1,203	1,036	86%
Indiana	829	675	81%
Iowa	848	395	47%
Kansas	577	403	70%
Kentucky	852	552	65%
Louisiana	556	387	70%
Maine	405	163	40%
Maryland	419	263	63%

Table 2. Fire Departments Reporting Fire Incidents to NFIRS in 2011 – continued

State	No. of Fire Departments in State	No. of Reporting Fire Departments (NFIRS 5.0)	Percent of Reporting Fire Departments (NFIRS 5.0)
Massachusetts	366	337	92%
Michigan	1,306	844	65%
Minnesota	784	722	92%
Mississippi	752	709	94%
Missouri	891	465	52%
Montana	392	169	43%
Nebraska	476	177	37%
Nevada	165	42	25%
New Hampshire	232	194	84%
New Jersey	740	653	88%
New Mexico	362	296	82%
New York	1,786	1,128	63%
North Carolina	1,257	1,038	83%
North Dakota	372	151	41%
Ohio	1,208	1,181	98%
Oklahoma	926	385	42%
Oregon	316	231	73%
Pennsylvania	2,287	700	31%
Rhode Island	76	36	47%
South Carolina	435	349	80%
South Dakota	337	191	57%
Tennessee	728	593	81%
Texas	2,025	996	49%
Utah	273	131	48%
Vermont	236	180	76%
Virginia	652	477	73%
Washington	487	323	66%
West Virginia	442	434	98%
Wisconsin	850	550	65%
Wyoming	145	64	44%
Native American	100	6	6%
Total	**33,111***	**20,680**	**62%**

Sources: NFIRS (2011) and state fire marshal's offices or equivalent organizations (September 2013).

Note: Additionally, there are 672 Department of Defense fire departments in the U.S. These departments are not included in the totals here and do not report their fire incident data to NFIRS.

* This total differs from the 2011 NFPA estimate of 30,145 fire departments. The NFPA estimate is the official estimate used by USFA as its benchmark for the National Fire Department Census.

Corresponding to increased participation, the numbers of fires, deaths and injuries, as well as estimates of dollar loss reported to NFIRS, also have grown; an estimated 71 percent of all U.S. fires to which fire departments responded in 2011 were captured in NFIRS.

There are, of course, many problems in assembling a real-world database, and NFIRS is no exception. Although NFIRS does not represent 100 percent of incidents reported to fire departments each year, the enormous dataset and good efforts by the fire service result in a huge amount of useful information. Because of advances in computer technology and data collection techniques over the past 35 years and improvements suggested by participants, NFIRS has been revised periodically. The newest revision, NFIRS 5.0, became operational in January 1999.

NFIRS 5.0 captures information on all incidents, not just fires, to which a fire department responds. In addition to many data coding improvements, version 5.0 provides 11 modules that recognize the increasingly diverse activities of fire departments today. These modules, together, contain 567 data elements or fields.

The Basic Module is the main module, which is completed for every incident. The other modules are filled out, when appropriate, to provide additional information on an incident. All 11 modules are listed below:

Module	Description
Basic Module	General information for each incident
Fire Module	Fire incident information
Structure Fire Module	Information on structure fires
Civilian Fire Casualty Module	Fire-related injuries or deaths to civilians
Fire Service Casualty Module	Injuries or deaths to firefighters
EMS Module	Medical incidents
Hazardous Materials Module	Hazardous materials incidents
Wildland Fire Module	Wildland or vegetation fires
Apparatus/Resources Module	Apparatus-specific information
Personnel Module	Personnel associated with apparatus
Arson Module	Intentionally set fire information

Data from the modules are grouped together each calendar year to create the Public Data Release (PDR) files in delimited text (.txt) format that are then released annually into the public domain. For NFIRS data submitted prior to 2012, the PDR files were released in dBASE format. The Apparatus/Resources and Personnel Modules are excluded from the PDR because they are intended for local fire department use, and the PDR dataset's main utility is intended for national analyses. The PDR files consist of a subset of the data fields contained within the NFIRS national production database. For example, data elements with sensitive or identifying information are removed as are data elements that are wholly used for maintenance or production purposes. The PDR files' data structure has been considerably simplified from the production database's schema for ease of use. The PDR files from 2004 to the present only include fire and hazmat incidents and their related data tables. Prior to 2004, all incidents were included in the PDR files.

In its basic form, the NFIRS PDR files have a relational data structure where data from each incident module is represented by a row in a data table. The primary tables (basic incident and incident address) contain most of the Basic Module data. There is exactly one record in the basic incident table for every incident reported to NFIRS. All other modules, represented by data tables with similar names (fire incident, civilian casualties, etc.), have records that are linked to the basic incident table through unique incident identification key fields (e.g., STATE, FDID, INC_DATE, INC_NO, and EXP_NO). Some module data are split across several tables (e.g., basic incident, incident address, and basic aid tables); one table (fire incident) combines data from two modules (i.e., Fire Module and Structure Fire Module). Some tables, such as fire incident, will only have one record for each relevant incident in the basic incident table, while tables such as civilian casualty may have several records linked to a single incident in the case where multiple injuries and/or deaths occur in the same incident.

The Basic Module and Fire Module of NFIRS 5.0 collect data in a different fashion than the precursor NFIRS systems. The design of NFIRS 5.0 makes the system easier to use than previous NFIRS versions because it captures only the data required to profile the extent of the incident. Some fires, for example, require just basic information to be recorded, whereas others require considerably more detail.

State participation is voluntary, and each state specifies NFIRS reporting requirements for its fire departments. States have the flexibility to adapt their state reporting systems to their specific needs. As a result, the design of a state's data collection system varies from state to state. NFIRS 5.0 was designed so that data from state systems can be converted to a single format that is used at the national level to aggregate and store NFIRS data.

One of the most important changes is in the data format itself. All data in the system, regardless of the entry mechanism, are in NFIRS 5.0 format; non-NFIRS 5.0 data are converted to the 5.0 format. The proportion of native 5.0 data has steadily increased since the introduction of NFIRS 5.0 in 1999 (Table 3). This proportion rose to 99 percent in the 2008 data. Since Jan. 1, 2009, NFIRS 4.1 data are no longer accepted by the system. Prior to 2009, NFIRS 4.1 data in its converted form had been accepted by the system; however, USFA only uses native 5.0 data in its NFIRS-based analyses.

Table 3. NFIRS Fire Incident Data Reporting by Version (percent)

Year	NFIRS 4.1 (converted to 5.0 format)	Native NFIRS 5.0
1999	92%	8%
2000	77%	23%
2001	48%	52%
2002	31%	69%
2003	19%	81%
2004	11%	89%
2005	5%	95%
2006	5%	95%
2007	2%	98%
2008	1%	99%
2009	0%	100%

Source: NFIRS.

NFIRS Enhancements

Under the USFA Reauthorization Act of 2008, the U.S. Congress authorized and funded USFA to develop enhancements to NFIRS. The upgrades to the system began in October 2008 and included a simplified NFIRS Web-based reporting interface and a data warehouse for generating output reports for use in analyses. These improvements make reporting and accessing the NFIRS data much easier for fire departments.

In July 2010, USFA completed and deployed the new Web-based data entry tool. The Data Entry Browser Interface (DEBI) is a one-purpose tool for use by the fire service to document incident information within NFIRS. While the functionality is the same as the NFIRS client Data Entry Tool that has been available for use for many years, DEBI allows entry of incidents using a standard Web browser, eliminating the need to download, install and configure client software.

The development of a flexible NFIRS data warehouse with comprehensive data mining capabilities was completed in July 2011. It is scheduled for deployment to national, state and fire department NFIRS users in three phases beginning in winter, 2014. The data warehouse will allow NFIRS users to access and report on nationally collected data with significantly increased functionality over the current report generation tool. The data have been transformed into a custom schema that greatly increases the speed of report generation and data access. NFIRS users will be able to generate reports using data from other departments and states, which was not previously possible. More detailed information regarding the NFIRS enhancements is available at http://www.usfa.fema.gov/fireservice/nfirs/enhancements/.

NFIRS Training

USFA offers several NFIRS training courses for fire departments that include the "NFIRS Program Management" course, "Introduction to NFIRS Self-Study," and the "Introduction to NFIRS 5.0" course. The "NFIRS Program Management" course enables participants to promote, support and manage NFIRS data collection successfully. The "Introduction to NFIRS Self-Study" (online) course provides an overview of the data collection system, its modules, and data conversion issues. The "Introduction to NFIRS 5.0" course emphasizes how to use standardized forms to achieve uniformity in incident and activity reporting. This training program is designed specifically to support local fire service organizations and assists them in providing data both to management and decision-makers, as well as to the state uniform fire reporting system. For more information on NFIRS training courses, visit http://www.usfa.fema.gov/fireservice/nfirs/training/. Additionally, USFA's NFIRS Support Center offers a consolidated national help desk to provide technical support to fire departments and NFIRS State Program Managers regarding all aspects of NFIRS.

Uses of NFIRS

NFIRS data are used extensively at all levels of government for major fire protection decisions. At the local level, incident and casualty information is used for setting priorities and targeting resources. The data collected are particularly useful for designing fire prevention and educational programs and EMS-related activities specifically suited to the real emergency problems local communities face.

At the state level, NFIRS is used in many capacities. One valuable contribution is that some state legislatures use these data to justify budgets and to pass important bills on fire-related issues such as sprinklers, fireworks and arson. Many federal agencies, in addition to USFA, make use of NFIRS data. NFIRS data are used, for example, by the Consumer Product Safety Commission (CPSC) to identify problem products and to monitor corrective actions. The Department of Transportation uses NFIRS data to identify fire problems in automobiles, which has resulted in mandated recalls. The Department of Housing and Urban Development uses NFIRS to evaluate safety of manufactured housing (mobile homes). The USFA uses the data to design prevention programs, to order firefighter safety priorities, to assist in the development of training courses at the National Fire Academy, and for a host of other purposes. Thousands of fire departments, scores of states, and hundreds of industries have used the data. The potential for even greater use remains. The USFA report, Uses of NFIRS: The Many Uses of the National Fire Incident Reporting System, further describes the uses of the data and is available online at http://www.usfa.fema.gov/downloads/pdf/publications/nfirsuse.pdf.

U.S. Fire Departments

The number of fire departments in each state (Table 2) was provided by each state's NFIRS Program Manager. The USFA also maintains a database of fire departments. The USFA established the National Fire Department Census and its subsequent database in the fall of 2001 when the USFA launched a nationwide campaign for voluntary registration of fire departments. Over 26,500 fire departments have registered with the census, about 88 percent of the estimated number of U.S. fire departments. The NFPA estimated that there were 30,145 fire departments in the U.S. in 2011.

The census database is intended for use by the fire protection and prevention communities, allied professions, the general public, and the USFA. USFA uses the database to conduct special studies, guide program decision-making, and improve direct communication with individual fire departments. The database provides a current directory of registered fire departments and includes basic information such as addresses, department types, website addresses (if applicable), number of fire department personnel, and number of stations. Population-protected and area-protected data are also collected. However, in previous analyses of the population-protected field, it was determined that the fire departments registered with the census reported protecting a population two times that of the U.S. population estimated by the U.S. Census Bureau. Similar results were seen for the area protected. The National Fire Department Census also collects information on specialized services that is released only in summary format. For more information about the National Fire Department Census or to download the list of registered fire departments, visit http://apps.usfa.fema.gov/census/.

METHODOLOGY

An attempt has been made to keep the data presentation and analysis as straightforward as possible. It is also the desire of the USFA to make the data analyses widely accessible to many different users, so it avoids unnecessarily complex methodology. The term **fire casualties** refers to deaths and injuries; the term **fire losses** collectively includes fire casualties and dollar loss.

Analytic Issues and Considerations

There are several longstanding issues regarding how to analyze NFIRS data when it is neither as complete nor as accurate as desired. Other analytic issues are the result of changes in definitions and data collection procedures from NFIRS 4.1 to NFIRS 5.0. The sections below discuss how the analyses address these and other issues.

National Estimates

National estimates are estimates of the numbers of fire losses (i.e., fires, deaths, injuries and dollar loss) associated with a subset of the fire data. High-level summary national estimates of the numbers for fires, deaths, injuries and dollar loss are based on NFPA's annual Survey of Fire Departments for U.S. Fire Experience.[6] With the exception of the NFPA estimates for total fires, structure (i.e., residential and nonresidential) fires, vehicle, outside and other fires, all other estimates are scaled-up national estimates or percentages, not just the raw totals from NFIRS. Because the NFIRS 5.0 data are not based on a statistically selected sample and do not represent a "complete" census of fire incidents, the raw counts of NFIRS data must be scaled up to national estimates. These estimates are based on a method of apportioning the NFPA estimates for total fires, structure fires, vehicle, outside and other fires.[7] Generally speaking, the national estimates are derived by computing a percentage of fires, deaths, injuries or dollar loss in a particular NFIRS category and multiplying it by the corresponding total estimate from the NFPA annual survey.[8] For example, the national estimate for the number of injuries by age group used in the calculation for the fire injury rate per million population was computed by taking the percentage of NFIRS fire injuries (with known age) and multiplying it by the estimated total number of fire injuries from the NFPA survey. This methodology is the accepted practice of national fire data analysts.

Ideally, one would like to have all of the data come from one consistent data source. Because the "residential population protected" is not reported to NFIRS by many fire departments and the reliability of that data element is suspect in many other cases, especially where a county or other jurisdiction is served by several fire departments that each report their population protected independently, this data element was not used. Instead, extrapolations of the NFIRS sample to national estimates are made using the NFPA survey for the gross totals of fires, deaths, injuries and dollar loss.

One problem with this approach is that the proportions of fires and fire losses differ between the large NFIRS sample and the NFPA survey sample. Nonetheless, to be consistent with approaches being used by other fire data analysts, the NFPA estimates of fires, deaths, injuries and dollar loss are used as a starting point. The details of the fire problem below this level are based on proportions from NFIRS. Because the proportions of fires and fire losses differ between NFIRS and the NFPA estimates, from time to time, this approach leads to minor inconsistencies. These inconsistencies will remain until all estimates can be derived from NFIRS data alone.

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6 For information on NFPA's survey methodology, please see NFPA's report on Fire Loss in the United States: http://www.nfpa.org/~/media/Files/Research/NFPA%20reports/Overall%20Fire%20Statistics/osfireloss.pdf.

7 National estimates are based on "The National Estimates Approach to U.S. Fire Statistics" by Hall and Harwood: http://www.nfpa.org/assets/files/PDF/Research/Nationalestimates.pdf.

8 The NFPA summary estimates are used for the overall U.S. fire losses; fire losses from structure, vehicle, outside and other fires; and as the basis for USFA's estimates of residential and nonresidential building fires. The alternative approach for these summary numbers is to use the relative percentage of fires (or other loss measures) from NFIRS and scale up (multiply by) the NFPA estimate of total fires.

Structures Versus Buildings

NFIRS 5.0 allows for the differentiation between buildings and nonbuildings. In NFIRS, a structure is a built object and can include platforms, tents, connective structures (e.g., bridges, fences), telephone poles, and various other structures in addition to buildings. Analyses of NFIRS structure fires show that, by and large, the majority (93 percent) of structure fires occurs in buildings.

The distinction between buildings and nonbuildings is particularly important when determining the effectiveness of nonbehavior-based fire safety mechanisms such as smoke alarms and residential sprinklers. These important components of early fire detection apply to buildings and not necessarily to these other types of structures. To facilitate analysis of these components and to acknowledge that prevention efforts generally are centered on buildings, USFA separates buildings from the rest of the structures. For these reasons, USFA focuses on producing building fire and loss estimates. USFA's Fire Estimate Summary Series as well as 2003-2011 national estimates of residential and nonresidential building fires and losses are published at http://www.usfa.fema.gov/statistics/estimates/index.shtm. For information on USFA's methodology for computing national estimates of residential and nonresidential building fires and losses, please review USFA's National Estimates Methodology for Building Fires and Losses (August 2012) at http://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_ methodology.pdf.

Unknown Entries

On a fraction of the incident reports or casualty reports sent to NFIRS, the desired information for many data items either is not reported or is reported as "unknown." The total number of blank or unknown entries is often larger than some of the important subcategories. For example, 46 percent of fatal fires in residential buildings reported from 2009-2011 do not have sufficient data recorded in NFIRS to determine fire cause.[9] The lack of data, especially for these residential fatal fires, masks the true picture of the fire problem. Many prevention and public education programs use NFIRS data to target at-risk groups or to address critical problems, fire officials use the data in decision-making that affects the allocation of firefighting resources, and consumer groups and litigators use the data to assess product fire incidence. When the unknowns are large, the credibility of the data suffers. In some cases, even after the best attempts by fire investigators, the information is truly unknown. In other cases, the information reported as unknown in the initial NFIRS report is not updated after the fire investigation is completed. Fire departments need to be more aware of the effect of incomplete data reporting and need to update the initial NFIRS report if additional information is available after investigation.

In making national estimates, the unknowns should not be ignored. The approach taken by USFA in presenting the data is to provide not only the "raw" percentages of each category but also the "adjusted" percentages computed using only those incidents for which data were provided. This calculation, in effect, distributes the fires for which the data are unknown in the same proportion as the fires for which the data are known, which may or may not be approximately right.

To illustrate, using the cause of residential building fires, cooking was determined as the fire cause for 37.3 percent of reported residential building fires in 2011; another 18.4 percent of reported fires had cause unknown. Thus, the percent of fires that had their cause reported was 100 minus 18.4 equals 81.6 percent. With the unknown causes proportioned like the known causes, the adjusted percent of cooking fires in residential buildings can then be computed as 37.3 divided by 81.6 equals 45.7 percent.

Both the reported data and the adjusted data (if unknowns are present) are plotted on bar charts.

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9 USFA, Topical Fire Report Series, "Fatal Fires in Residential Buildings (2009-2011)," Volume 14, Issue 3, May 2013 (http://www.usfa.fema.gov/downloads/pdf/statistics/v14i3.pdf).

Incomplete Loss Reporting

As troublesome as insufficient data for the various NFIRS data items can be, equally challenging is the apparent nonreporting of injuries and property loss associated with many fire incidents. For example, there are many reported fires where the flame spread indicates damage but property loss is not reported. It is notoriously difficult to estimate dollar loss, but an approximation is more useful than leaving the data item blank. The degree to which there is incomplete reporting of civilian fire deaths is more difficult to identify, as the numbers of deaths are relatively small. Incomplete reporting of civilian injuries also is difficult to ascertain, but the injury-per-fire profiles for most departments are within reason.

Representativeness of the Sample

The percentage of fire departments participating in NFIRS varies from state to state, with some states not participating at all in some years. To the best that USFA can determine, the distribution of participants is reasonably representative of the entire nation, even though the sample is not random. The dataset is so large — on average about 65 percent of all fires — and reasonably distributed geographically and by size of community that it is used as input to develop national estimates.

In a joint study effort, USFA and NFPA examined the biases in NFIRS participation, specifically whether the fire experience of NFIRS-reporting departments differed systematically from the fire experience of other non-reporting departments within the same population. Results based on data from 1997 and 2002 indicated that there were differences in total fire-loss estimates derived from NFIRS reporting departments and non-NFIRS reporting departments; however, the degree of difference was not great enough to merit adjusting current scaling methodologies. Thus, USFA and fire data analysts from other organizations continue to use the long-standing methodology of scaling NFIRS estimates with NFPA total fire estimates.

In the fall of 2008, as required by the U.S. Office of Management and Budget (OMB), USFA undertook a study of the NFIRS dataset to examine the potential bias in NFIRS due to fire department nonresponse. As a result, USFA completed an analysis to identify fire departments that do not participate in NFIRS, characteristics of these departments, and whether their nonresponse impacted the representativeness of NFIRS. Undertaken on a regional and county basis, the analysis provided insight into what, if any, adjustments could be made to minimize the impact of possible reporting bias on the fire-loss estimates. States of particular concern for nonreporting were located in the Northeast and West regions of the country where the average rates of reporting were approximately 72 percent for each of these regions. By contrast, the Midwest region had an estimated 87 percent reporting rate.

In 2011, USFA also completed a second NFIRS representativeness study as required by OMB. For this study, USFA compared the NFIRS database to NFPA proprietary data to determine the percentage of departments responding to the NFPA survey that also reported fires to NFIRS. It was determined that 87 percent of the 2009 NFPA survey respondents also reported fire incidents to NFIRS from 2007 to 2009. In 2009 alone, more than 18,000 additional departments (i.e., in addition to those responding to the NFPA survey) reported fires to NFIRS.

It is important to note that USFA along with other federal agencies does not use NFIRS data to derive state-level fire estimates. NFIRS data are used to show the fire problem at the national level. Because the findings in USFA's latest NFIRS representativeness study show a very high percentage of the NFPA respondents are also reporting fires to NFIRS, fire departments across the country appear to be well-represented in NFIRS.

Additionally, most of the NFIRS data exhibit stability from one year to the next, without radical changes. Results based on the full dataset are generally similar to those based on part of the data, another indication of data reliability. Although improvements could be made — the individual incident reports could and should be filled out more completely and more accurately than they are today (as can be said about most real-world data collections as large as NFIRS), and all participating departments should have the same reporting requirements — the overall portrayal is a reasonably accurate description of the fire situation in the U.S.

Unreported Fires

NFIRS only includes fires to which the fire service responded. In some states, fires attended by state fire agencies (such as forestry) are included; in other states, they are not.

Nonreporting to NFIRS

NFIRS includes fires from all states but does not include incidents from all fire departments within participating states; the percent of fire departments reporting varies greatly from state to state. However, if the fires from the reporting departments are reasonably representative, this omission does not cause a problem in making useful national estimates for any but the smallest subcategories of data and for some geographic analyses.

Some fire departments submit information on most, but not all, of their fires. Sometimes the confusion is systematic, as when no-loss cooking fires or chimney fires are not reported. Sometimes it is inadvertent, such as when incident reports are lost or accidentally not submitted. The information that is received is assumed to be the total for the department and is extrapolated as such. Although there was no measure of the extent of this problem in the past, the NFIRS 5.0 provides fire departments with the capability to report this information in a simplified, more straightforward manner.

Nonreporting to the Fire Service

A very large number of fires are not reported to the fire service at all. Most are believed to be small fires in the home or in industry that go out by themselves or are extinguished by the occupant. Special surveys of homes and businesses are needed to estimate the unreported fires. No attempt is made here to estimate them. Studies undertaken in the mid-1970s, mid-1980s and again in the mid-2000s on unreported residential fires indicated that a substantial number of fires are not reported to local fire departments. The 2004-2005 CPSC study on unreported residential fires noted that, of the estimated number of fires in residences, only 3 percent were reported to fire departments and 97 percent were not.[10] Although the vast majority of fire incidents are unreported because they are small, confined and immediately extinguished, they are still fires. Even the largest fire starts small. Hence, all fires, regardless of size, merit prevention attention and analytic investigation.

Computing Trends

A frequently asked question is how much a particular aspect of the fire problem has changed over time. The usual response is in terms of a percent change from one year to another. As we are dealing with real-world data that fluctuate from year to year, a percent change from one specific year to another can be misleading. This is especially true when the beginning and ending data points are extremes, either high or low. For example, Table 4 shows that the percent change from 9,125 fire injuries in one- and two-family residential buildings in 2007 to 8,925 fire injuries in 2011 would be a decrease of 2.2 percent; however, if we were to choose 2009 as the beginning data point (8,125 fire injuries), this change would show a substantial 9.8 percent **increase**. As we are interested in **trends** in the U.S. fire problem, USFA presents the computed best-fit linear trend line (which smooths fluctuations in the year-to-year data) and presents the change over time based on this trend line. The overall five-year trend is a decrease in injuries of 1.3 percent which, in this example, is relatively close to the point-to-point change between the five years. As noted above, trends that incorporate NFIRS data from the 5.0 system may have subtle changes as a result of the system design and not a true trend change.

Table 4. Comparison of Percent Change Indicators

Year	One- and Two-Family Residential Building Fire Injuries	Best-Fit Linear Trend	Change Between 2007 and 2011	Change Between 2009 and 2011
2007	9,125	8,675	9,125	
2008	8,400	8,648		
2009	8,125	8,620		8,125
2010	8,525	8,593		
2011	8,925	8,565	8,925	8,925
Percent change		-1.3%	-2.2%	9.8%

Source: USFA national estimates of one- and two-family residential building fire injuries.

10 Michael A. Greene and Craig Andres, Division of Hazard Analysis, Directorate for Epidemiology, U.S. Consumer Product Safety Commission, 2004-2005 *National Sample Survey of Unreported Residential Fires*, July 2009.

Rounding

Percentages on each chart are rounded to one decimal point. Textual discussions cite these percentages as whole numbers. Thus, 13.4 percent is rounded to 13 percent and 13.5 percent is rounded to 14 percent. National estimates are rounded as follows: Fires are rounded to the nearest 100 fires, deaths to the nearest five deaths, injuries to the nearest 25 injuries, and loss to the nearest million dollars.

Comparing Statistics

Differences between the current NFIRS and older versions have, or may have, an effect on the analyses of fire topics. These differences, the result of both coding changes and data element design changes, required revisions to long-standing groupings and analyses. The revisions have caused some challenges when comparing current data to past data.

Data Collection and Reporting Changes

Streamlined reporting for qualified incidents, the collection of smoke alarm and automatic extinguishing system (AES) data (formerly called sprinklers), definition changes for some property types, the differentiation between buildings and structures, and changes in the cause methodology are among the areas that are approached differently in NFIRS 5.0.[11] These revisions have resulted in changes in overall trends, some subtle and some substantial.

Confined Fires

The limited reporting of confined, low-loss structure fires allows the fire service to capture incidents that either might have gone unreported prior to the introduction of NFIRS 5.0 or were reported, but as a nonfire incident, as no loss was involved.[12] Data from this reporting option for structure fires were investigated in a 2006 USFA report, Confined Structure Fires. The addition of these fires results in increased proportions of cooking and heating fires in analyses of structure fire cause. In other analyses, the inclusion of confined fires may result in larger unknowns, as detailed reporting of fire specifics is not required. In many USFA analyses, the confined fires are analyzed separately from the nonconfined fires to account for the fact that detailed reporting is not required for the confined fires. In 2011, confined fires accounted for 17 percent of all fires and 45 percent of structure fires. Eighty-one percent of confined structure fires were no- or low-loss cooking fires (65 percent) and heating fires (16 percent).

Definitional Changes

Property Types

Examples of property type changes include manufacturing and properties that are vacant and under construction. Manufacturing properties are no longer assigned a specific property use code based on the type of item manufactured. Instead, these properties are differentiated by an additional data element, "on-site materials." Vacant and under construction now is an attribute of a structure and no longer is considered a separate property type.

Buildings and Structures

NFIRS 5.0 allows for the differentiation between buildings and nonbuildings. In NFIRS 5.0, a structure is a built object and can include platforms, tents, connective structures (e.g., bridges), and various other structures (e.g., fences, underground work areas). This distinction between buildings and nonbuildings is important when determining the effectiveness of engineered fire safety features such as smoke alarms and AES. These important components of early fire detection and automatic suppression apply to buildings and not necessarily to other types of structures. To facilitate analysis of these components and to acknowledge that prevention efforts generally are focused on buildings, USFA separates the subset of buildings from the rest of the structures.

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11 Other changes between NFIRS 4.1 and 5.0, such as mutual aid, do not have as significant an impact on analyses. As such, they are not addressed here. The NFIRS 5.0 documentation at http://www.nfirs.fema.gov/documentation/ provides detailed information.

12 Some states routinely reported such nonloss fires as smoke scares. The result, from a reporting viewpoint, is that the incident is reported, but not coded as a fire incident.

Structure fires are defined by the NFIRS incident type. Structure fires are defined as the 110 Incident Type Series (structure fires) and the 120 Incident Type Series (fires in mobile property used as a fixed structure).[13] These incident types are:

- 111 Building fire.
- 112 Fires in structure other than in a building.[14]
- 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.

Building fires are a subset of structure fires. They are defined as structure fires where the structure type is an enclosed building, a fixed portable, or mobile structure. By definition, this excludes nonbuilding structures. Previous USFA analyses demonstrated that confined structure fire incidents with full incident reporting primarily occurred in buildings. To accommodate the confined fire incident types with abbreviated incident reporting, the incident is also assumed to be a building if the structure type is not specified. In terms of NFIRS data, building fires are therefore defined as:

- NFIRS version 5.0 data.
- Aid Types:
  - 1 Mutual aid received.
  - 2 Automatic aid received.
  - 5 Other aid given.

  Note: Mutual aid given and automatic aid given (Aid Types 3 and 4) were excluded to avoid double counting of incidents.
- Incident Types 111-123 (excluding Incident Type 112):
  - 111 Building fire.
  - 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.

  Notes: (1) Incident Types 113-118 do not specify if the structure is a building. (2) Incident Type 112 was included in data analyses prior to 2008 as previous analyses showed that Incident Types 111 and 112 were used interchangeably. As of 2008, Incident Type 112 is excluded.

13 Note that Incident Type 110 is not included. Incident Type 110 is a conversion code for NFIRS 4.1. Incident Type 110 is not a valid code for data collected in NFIRS 5.0. Incidents in the NFIRS 5.0 database with a 110 Incident Type are incidents collected under the NFIRS 4.1 system and are converted to NFIRS 5.0 compatible data.

14 Preliminary findings noted that the fires coded as 112 appear to be buildings. A more detailed look at these incident types is required to determine whether they were coded correctly.

- Structure type:
  - For Incident Types 113-118:
    - Enclosed building.
    - Fixed portable or mobile structure, and structure type not specified (null entry).
  - For Incident Types 111 and 120-123:
    - 1 Enclosed building.
    - 2 Fixed portable or mobile structure.

Structure Fire Cause Methodology

Since the introduction of NFIRS version 5.0, the implementation of the cause hierarchy has resulted in a steady increase in the percentages of unknown fire causes. This increase may be due, in part, to the fact that the original cause hierarchy (described in "Fire in the United States 1995-2004," 14th edition) does not apply as well to version 5.0. Causal information now collected as part of NFIRS version 5.0 was not incorporated in the old hierarchy. As a result, many incidents were assigned to the unknown cause category. As the hierarchy was originally designed for structures, incidents that did not fit well into the structure cause categories were also assigned to the unknown category.

Structure Fires

To capture the wealth of data available in NFIRS 5.0, USFA developed a modified version of the previous cause hierarchy for structure fires as shown in Table 5. The revised schema provides three levels of cause descriptions: a set of more detailed causes (priority cause description), a set of mid-level causes (cause description), and a set of high-level causes (general cause description). The priority cause description and the cause description existed previously as part of the original cause hierarchy but have been expanded to capture the new 5.0 data.

Table 5. Three-Level Structure Fire Cause Hierarchy

Priority Cause Description (in hierarchical order)	Cause Description	General Cause Description
Exposure	Exposure	Exposure
Intentional	Intentional	Firesetting
Cause under investigation	Cause under investigation	Unknown
Children playing	Playing with heat source	Firesetting
Other playing		
Natural	Natural	Natural
Fireworks	Other heat	Flame, heat
Explosives		
Smoking	Smoking	
Heating	Heating	Equipment
Cooking	Cooking	
Air conditioning	Appliances	
Electrical distribution	Electrical malfunction	Electrical
Appliances	Appliances	Equipment
Special equipment	Other equipment	
Processing equipment		
Torches	Open flame	Flame, heat
Service equipment	Other equipment	Equipment
Vehicle, engine		
Unclassified fuel-powered equipment		

Table 5. Three-Level Structure Fire Cause Hierarchy – continued

Priority Cause Description (in hierarchical order)	Cause Description	General Cause Description
Unclassified equipment with other or unknown fuel source	Unknown	Unknown
Unclassified electrical malfunction	Electrical malfunction	Electrical
Matches, candles	Open flame	Flame, heat
Open fire		
Other open flame, spark	Other heat	
Friction, hot material		
Ember, rekindle	Open flame	
Other hot object	Other heat	
Natural condition, other	Natural	Natural
Heat source or product misuse	Other unintentional, careless	Unknown
Equipment operation deficiency	Equipment misoperation, failure	Equipment
Equipment failure, malfunction		
Trash, rubbish	Unknown	Unknown
Other unintentional	Other unintentional, careless	
Exposure (fire spread, other)	Exposure	Exposure
Unknown	Unknown	Unknown

Source: USFA.

Note: Fires are assigned to a cause category in the hierarchical order shown. 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 on the list.

The causes of fires are often a complex chain of events. To make it easier to grasp the "big picture," the 16 mid-level categories of fire causes such as heating, cooking and playing with heat source are used by the USFA. The alternative is to present scores of detailed cause categories or scenarios, each of which would have a relatively small percentage of fires. For example, heating includes subcategories such as misuse of portable space heaters, wood stove chimney fires, and fires involving gas central heating systems. Experience has shown that the larger categories are useful for an initial presentation of the fire problem. A more detailed analysis can follow.

Fires are assigned to one of the 16 mid-level cause groupings using a hierarchy of definitions, approximately as shown in Table 6.[15] A fire is included in the highest category into which it fits on the list. If it does not fit the top category, then the second one is considered, and if not that one, the third and so on. (See the note section in Table 5 for examples.)

Vehicle, Outside and Other Fires

While these new cause categories have usefulness for the other property types — vehicle, outside and other fires — there are limitations. USFA plans to investigate and develop specific cause categories for vehicle, outside and other fires. Until then, the causes of fires for these property types are based on the distributions of the NFIRS cause of ignition data element. This data element captures a very broad sense of the cause of the fire.

Deaths, Injuries and Dollar Loss

In previous analyses, the cause sections have included the distributions of deaths, injuries and dollar loss by fire cause. In principle, it is the cause of the ***fire*** which results in deaths, injuries and dollar loss that should be analyzed, not numbers of deaths and injuries associated with fire causes. Therefore, analyses of fire cause will address fires that cause deaths (fatal fires), fires that cause injuries, and fires that cause dollar loss.

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15 The structure fire cause hierarchy and specific definitions in terms of the NFIRS 5.0 codes may be found at http://www.usfa.fema.gov/fireservice/nfirs/tools/fire_cause_category_matrix.shtm. The hierarchy involves a large number of subcategories that are later grouped into the 16 mid-level cause categories, then the eight high-level cause groupings.

Other Considerations

An additional problem to keep in mind when considering the rank order of causes is that sufficient data to categorize the cause were not reported to NFIRS for all fatal fires in the database. The rank order of causes might be different than shown here if the cause profile for the fires where causes were not reported to NFIRS were substantially different from the profile for the fires where causes were reported. However, there is no information available to indicate that there is a major difference between the known causes and the unknown causes, and so our present best estimate of fire causes is based on the distribution of the fires with known causes.

Table 6. Mid-Level Cause Groupings

Cause Category	Definition
Exposure	Caused by heat spreading from another hostile fire.
Intentional	Cause of ignition is intentional or fire is deliberately set.
Cause under investigation	Cause is under investigation and a valid NFIRS Arson Module is present. (This category was formerly called "Investigation with Arson Module.")
Playing with heat source	Includes all fires caused by individuals playing with any materials contained in the categories below as well as fires where the factors contributing to ignition include playing with heat source. Children playing with fire are included in this category.
Natural	Caused by the sun's heat, spontaneous ignition, chemicals, lightning, static discharge, high winds, storms, high water including floods, earthquakes, volcanic action and animals.
Other heat	Includes fireworks, explosives, flame/torch used for lighting, heat or spark from friction, molten material, hot material, heat from hot or smoldering objects.
Smoking	Cigarettes, cigars, pipes and heat from undetermined smoking materials.
Heating	Includes confined chimney or flue fire, fire confined to fuel burner/boiler malfunction, central heating, fixed and portable local heating units, fireplaces and chimneys, furnaces, boilers, water heaters as source of heat.
Cooking	Includes confined cooking fires, stoves, ovens, fixed and portable warming units, deep fat fryers, open grills as source of heat.
Appliances	Includes televisions, radios, video equipment, phonographs, dryers, washing machines, dishwashers, garbage disposals, vacuum cleaners, hand tools, electric blankets, irons, hairdryers, electric razors, can openers, dehumidifiers, heat pumps, water cooling devices, air conditioners, freezers and refrigeration equipment as source of heat.
Electrical malfunction	Includes electrical distribution, wiring, transformers, meter boxes, power switching gear, outlets, cords, plugs, surge protectors, electric fences, lighting fixtures, electrical arcing as source of heat.
Other equipment	Includes special equipment (radar, x-ray, computer, telephone, transmitters, vending machine, office machine, pumps, printing press, gardening tools, agricultural equipment), processing equipment (furnace, kiln, other industrial machines), service, maintenance equipment (incinerator, elevator), separate motor or generator, vehicle in a structure, unspecified equipment.
Open flame, spark (heat from)	Includes torches, candles, matches, lighters, open fire, ember, ash, rekindled fire, backfire from internal combustion engine as source of heat.
Other unintentional, careless	Includes misuse of material or product, abandoned or discarded materials or products, heat source too close to combustibles, other unintentional (mechanical failure/malfunction, backfire).
Equipment misoperation, failure	Includes equipment operation deficiency, equipment malfunction.
Unknown	Cause of fire undetermined or not reported.

Source: USFA.

NFIRS fire causal data can be analyzed in many ways, such as by the heat source, equipment involved in ignition, factors contributing to ignition, or many other groupings. The hierarchy of causes used has proven to be useful in understanding the fire problem and targeting prevention, but other approaches are useful too. Because the NFIRS database stores records fire-by-fire, and not just in summary statistics, a wide variety of analyses is possible.

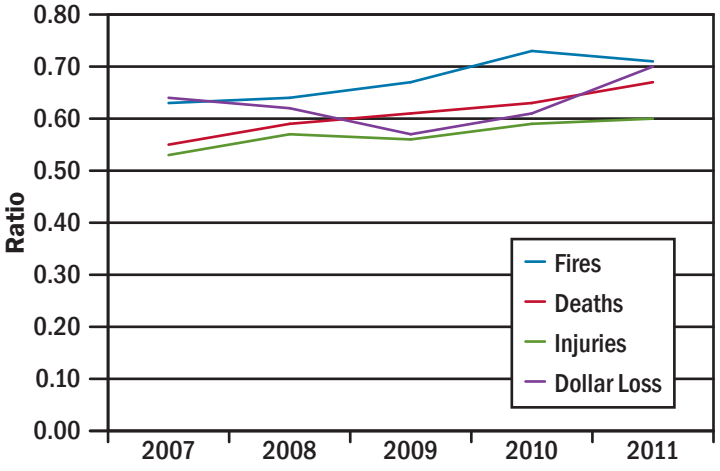
The cause categories displayed in the graphs of USFA's NFIRS data-related reports are listed in the same order to make comparisons easier from one to another. The y-scale varies from figure to figure depending on the largest percentage that is shown; the y-scale on a figure with multiple charts, however, is always the same.

Differences Between NFIRS Data and NFPA Survey Data

As there are differences between any two analysts using NFIRS data because of the many assumptions and decisions about how to analyze incomplete and imperfect data, there can be inconsistencies between different data sources. In particular, there are discrepancies between the NFIRS 5.0 data and the NFPA annual survey data. NFIRS 5.0 deaths and injuries per 1,000 fires are lower than those of NFPA. With the exception of 2007, NFIRS 5.0 dollar loss per fire is lower than that of NFPA.[16]

NFIRS collects fire incident data from an average of 20,320 fire departments each year. NFPA annual survey of fire departments[17] collects data from nearly 3,000 fire departments. NFIRS is not a statistically selected sample; however, it is a very large set of fire incidents — estimated to be, on average, two-thirds of reported fires. The NFPA survey is based on a statistical sample. These two datasets often yield dramatically different fire rates. The NFPA survey collects tallied totals, whereas NFIRS collects individual incident reports. During the period examined, the proportion of native NFIRS 5.0 fire data rose from 98 percent of all NFIRS fire incidents collected in 2007 to 100 percent of all NFIRS fire incidents starting in 2009. It is not surprising, therefore, that there are differences between the NFPA annual survey results and the NFIRS results. In the years examined (2007 to 2011), the common thread was the increase in the ratios of NFIRS data to the NFPA estimates. In general, the deaths reported to NFIRS represented a smaller fraction of the NFPA national estimate of deaths than the NFIRS number of fires was of the NFPA estimate of fires. Estimates of dollar loss are notoriously inexact; it is not surprising that the NFIRS dollar loss changed from year to year with respect to NFPA totals (Figure 2).

Figure 2. Ratio of Raw NFIRS Sample to NFPA National Estimates



	Fires	Deaths	Injuries	Dollar Loss
2007	0.63	0.55	0.53	0.64
2008	0.64	0.59	0.57	0.62
2009	0.67	0.61	0.56	0.57
2010	0.73	0.63	0.59	0.61
2011	0.71	0.67	0.60	0.70

Sources: NFPA and NFIRS.
Note: The 2007 dollar loss excludes the one-time large loss of an estimated $1.8 billion associated with the 2007 California Fire Storm. The 2008 dollar loss excludes the one-time large loss of an estimated $1.4 billion associated with the 2008 California Wildfires. These losses do not have associated property uses.

Looking at the problem from a different perspective, Figure 3 shows the number of deaths per 1,000 fires, injuries per 1,000 fires, and dollar loss per fire from NFIRS and NFPA from 2007 to 2011. In general, deaths and injuries per 1,000 fires and dollar loss per fire were lower for NFIRS than for NFPA. This difference may be the result of more low-loss fires being reported to NFIRS as a result of the abbreviated reporting option for these fires.

16 As NFIRS 5.0 now captures a large number of small, low-loss fires (confined fires) thought to be unreported previously, these differences in loss rates per fire may not be surprising.

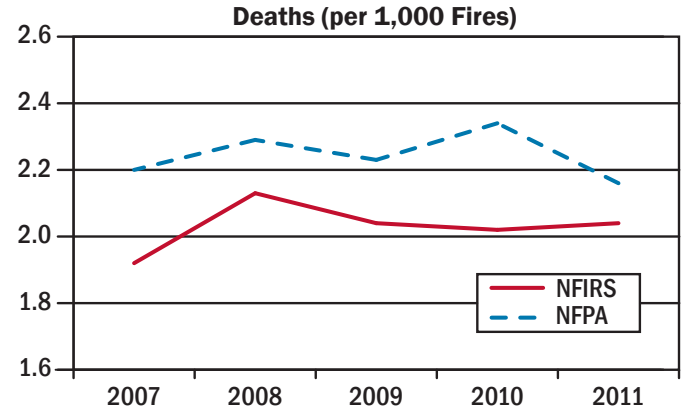
17 "Fire Loss in the United States," *NFPA Journal*, generally the September/October issue each year.

Between 2007 and 2011 NFIRS had, on average, a difference of 10 percent fewer fire deaths per 1,000 fires than the NFPA survey data. Annually, the NFIRS percentage differences of fire deaths per 1,000 fires ranged from 6 to 14 percent lower than that of NFPA. In 2011, NFIRS showed only 6 percent fewer fire deaths per 1,000 fires than NFPA.

Injuries per 1,000 fires revealed a much greater disparity between the two datasets. On average, between 2007 and 2011, NFIRS had a difference of 16 percent fewer fire injuries per 1,000 fires than the NFPA survey.

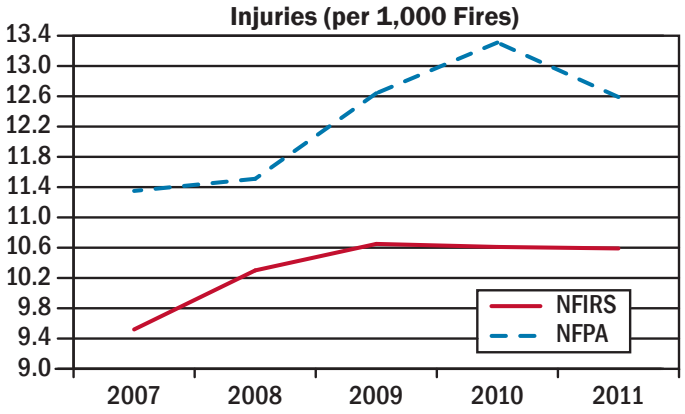
On average over the five-year period, the NFIRS dollar loss per fire was 7 percent lower than that of the NFPA survey. In 2008 and 2011, NFIRS dollar loss was only 3 percent and 2 percent lower, respectively, than the dollar-loss estimates from the NFPA survey but revealed a much greater disparity in 2009 (15 percent) and 2010 (17 percent). In 2007, more dollar loss was reported to NFIRS per fire than that reflected in the NFPA survey data.

Figure 3. NFIRS Versus NFPA Survey: Losses per Fire



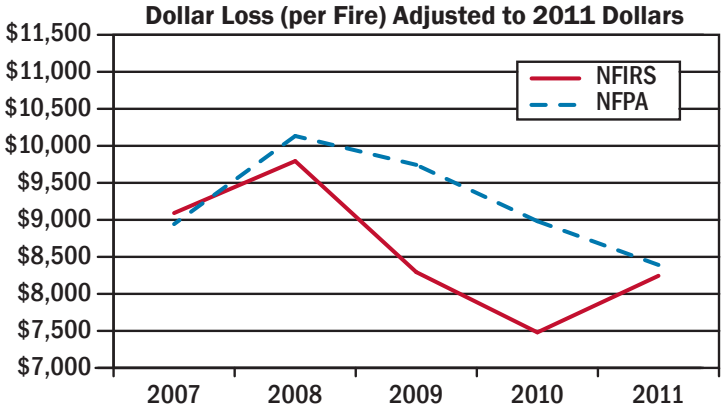
Deaths (per 1,000 Fires)

Year	NFIRS	NFPA
2007	1.92	2.20
2008	2.13	2.29
2009	2.04	2.23
2010	2.02	2.34
2011	2.04	2.16



Injuries (per 1,000 Fires)

Year	NFIRS	NFPA
2007	9.52	11.35
2008	10.30	11.51
2009	10.65	12.64
2010	10.61	13.31
2011	10.59	12.59



Dollar Loss (per Fire)*
*** Adjusted to 2011 Dollars**

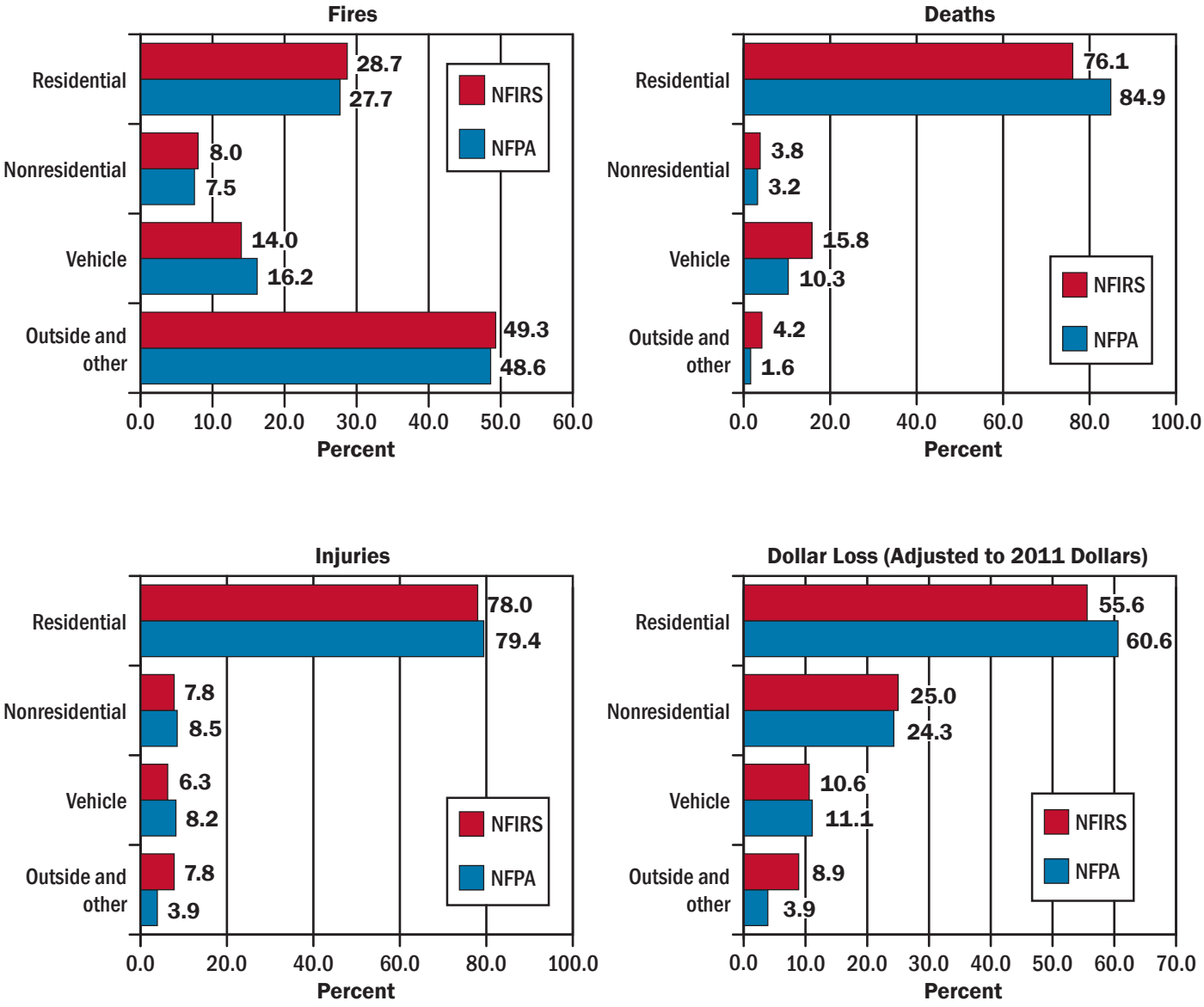
Year	NFIRS	NFPA
2007	9,092	8,943
2008	9,794	10,133
2009	8,294	9,743
2010	7,480	8,982
2011	8,244	8,391

Sources: NFPA, NFIRS and consumer price index.

Note: The 2007 dollar loss excludes the one-time large loss of an estimated $1.8 billion associated with the 2007 California Fire Storm. The 2008 dollar loss excludes the one-time large loss of an estimated $1.4 billion associated with the 2008 California Wildfires. These losses do not have associated property uses.

Other minor differences appear when reviewing losses by property type as shown in Figure 4. Specifically, the distributions of fires across property types between NFIRS and NFPA were quite similar, which is reassuring. Over the five-year period, the proportions of structure fires (both residential and nonresidential) and outside and other fires were slightly higher in the NFIRS sample while the proportion of vehicle fires was slightly more represented in the NFPA estimate. Regardless of the specifics, the distributions were reasonably comparable.

Figure 4. Comparison of NFIRS Data with NFPA Estimates by Incident Type (5-year average, 2007-2011)



Sources: NFPA and NFIRS.

The deaths, injuries and dollar losses that result from these fires were consistently more heavily represented in residential structures in the NFPA estimates. For the other major property categories (except vehicular fire injuries and dollar loss and nonresidential structure fire injuries), the NFPA percentages of losses are consistently less than those resulting from NFIRS data.

One of the more important consequences of these distributions is in the creation of estimates of the various parts of the U.S. fire problem. For example, it is noted that the 2011 NFPA residential structure fire estimates reflect 85 percent of fire deaths (2,550 of 3,005) and 82 percent of fire injuries (14,360 of 17,500). If the 2011 NFIRS percentages for deaths (76 percent) and injuries (79 percent) were applied to the overall 2011 NFPA estimates, the estimates would yield approximately 2,275 deaths and 13,850 injuries, both of which are substantially less.

The reasons for these differences in distributions between NFPA and NFIRS are not known. It may be that some departments reporting summary data to NFPA inadvertently undercount their casualties and losses when reporting on the NFPA survey forms. Another possibility is that there are data entry errors in NFIRS, with larger numbers of deaths, injuries and dollar loss per incident record creeping into the database despite edit checks at state and federal levels. (It appears that at least some of the dollar-loss difference is due to this.)

A third possibility for the differences is that with the introduction of abbreviated reporting of small, no-loss confined fires in NFIRS, the NFPA sample of these fires is not adequately represented. It is known that, prior to abbreviated NFIRS reporting, some departments did not fill out NFIRS forms for minor fires such as food on stoves or chimney fires. It is not clear whether these fires were or were not included in the department's report to NFPA and whether this reporting has changed. Also unknown is the actual extent of this problem.

A fourth possibility is that some jurisdictions use NFIRS as a tracking system for fire casualty information without providing the related incident data or vice versa. We know that this possibility does indeed occur from time to time in NFIRS. Again, we are unsure of how these incidents and their corresponding losses are reported to NFPA.

Lastly, it could be that techniques used to generate the NFPA estimates unintentionally favor residential buildings or that NFIRS, because it is a voluntary system and not a true statistical sample, may result in fewer residential losses.

Resolving the differences between the two major sources of fire statistics in the U.S. is important to prevent confusion among users of the data.