

The National Fire Incident Reporting System and the Public Data Release File

About NFIRS

This guide provides a brief overview of the U.S. Fire Administration's (USFA) National Fire Incident Reporting System (NFIRS), its data, and its limitations in data analyses at the state and national levels, as well as analytic resources. A brief overview of the PDR files is also discussed.

What is NFIRS?

The NFIRS is a voluntary, all-incident based reporting system used by fire departments across the country to record detailed information about the incidents attended. The NFIRS is based on a reporting standard that fire departments use to uniformly report on a wide range of their activities, from fire to Emergency Medical Services (EMS) to equipment involved in the response.

- The NFIRS constitutes the world's largest, national, annual collection of incident information.
- Since 2009, all 50 states, the District of Columbia, and Native American Tribal Authorities have reported incidents to the NFIRS every year. State participation is voluntary, and each state specifies NFIRS reporting requirements for its fire departments. Regardless of state participation in the system, all fire departments are eligible to report to the NFIRS.
- About 22,700 fire departments (76% of all fire departments nationwide¹) reported in the NFIRS in 2020 and are captured in the 2020 NFIRS PDR.² These fire departments reported over 26,900,000 runs or responses to all incidents including nearly 1,061,000 fire runs in 2020.³

What NFIRS is Not

- NFIRS is not a survey based on a statistically selected sample.⁴
- NFIRS is not a complete census of reported incidents in the U.S.⁵

¹ For 2018, the National Fire Protection Association (NFPA) estimated that there were 29,705 fire departments in the U.S. Source: NFPA, U.S. Fire Department Profile 2018, <https://www.nfpa.org/News-and-Research/Data-research-and-tools/Emergency-Responders/US-fire-department-profile>, February 2020.

² The 22,700 fire departments reflect only those departments submitting responses that were included in the 2020 NFIRS Public Data Release (PDR) file. Only NFIRS valid and released incidents are included in the PDR.

³ The terminology "runs or responses" does not reflect single incidents but can include mutual aid responses to the same incident.

⁴ A *sample* is a subset of measurements selected from the population; a finite part of a statistical population whose properties are studied to gain information about the whole.

⁵ A *census* is an official count or a complete enumeration of a population.

Consequently, the NFIRS does not capture all incidents and associated losses that occur across the U.S. each year.

What this Means

The raw data as reported to the NFIRS can be used to:

- Identify issues that occur only rarely at the local and state levels but may be detectable at the national level.
- Determine percentages of reported incidents by specific data elements or fields.
- Derive reported loss per incident statistics.
- Determine leading causes and factors of specific types of fires.

Raw NFIRS data should not be used to represent total counts of incidents and associated losses (i.e., casualties and dollar loss) at the national or state levels. If, however, raw NFIRS data are used for analyses, it should be noted as such (i.e., results are based on “reported NFIRS data” or “data as reported to the NFIRS”).

Using raw NFIRS data alone at the national and state levels to represent total incident counts is not a proper use of the data because:

- NFIRS participation is voluntary at the national level, and in most cases, the state level as well.
- NFIRS is not a complete census of reported incidents in the U.S. nor is it based on a statistically selected sample.

For these reasons, the USFA computes national estimates.

What are National Estimates?

National estimates are estimates of the numbers of incidents associated with a subset of the data.⁶ For example, where fire incidents are of interest, national estimates are estimates of the numbers of fires and losses (i.e., fires, deaths, injuries and dollar loss) associated with a subset of the fire data. High-level summarized national estimates of the numbers for fires, deaths, injuries and dollar loss are based on the NFPA’s annual Survey of Fire Departments for U.S. Fire Experience. Except for the NFPA estimates of 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 the NFIRS.

Because 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. The national estimates are derived by

⁶ An estimate is an approximation of a count or total.

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.

The NFPA's Survey of Fire Departments for U.S. Fire Experience is based on a stratified random sample of U.S. fire departments. The sample of departments is stratified by size of community protected, and ratio estimation methodology is used to develop national-level summary estimates on fire loss statistics (the total numbers of reported fires, fire deaths, fire injuries and direct dollar loss) as well as summary estimates of fires and losses by major incident types (i.e., structure, vehicle, outside and other). For more detailed information regarding the NFPA's survey methodology, see the NFPA's "Methodology used in calculating national estimates from NFPA's fire experience survey," August 2021, <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/US-Fire-Problem/Methodsfirelossandothers.ashx>. National estimates are based on "The National Estimates Approach to U.S. Fire Statistics" by Hall and Harwood.

Is the data representative?

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

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.

The USFA as well as other federal agencies do not use NFIRS data to derive state-level estimates. The NFIRS data are used to produce estimates at the national level.

What is the quality of the data in NFIRS?

Data quality is an area of great importance. The following 3 criteria are used in monitoring data in the NFIRS during the year: the data are complete; the data are accurate; and the data are current. These criteria are monitored by creating reports from the database that show the number of reporting fire departments, the number of incidents by state, the number of invalid incidents, and the number of unreleased incidents. The USFA provides the reports to the state NFIRS program managers and works with them to resolve any data issues. Technical assistance (e.g., telephone support or site visits) is provided to states to help address any data quality and data reporting needs.

Audits of the data are performed during the year to identify any inconsistencies. The audits focus on three criteria: gaps in reporting, critical errors in the data, and outliers in the data. In particular, the USFA works closely with states to monitor the quality of data coming from third party vendor software. The USFA assists states in monitoring vendor data quality issues or contacts vendors directly to discuss an issue at a state's request. Other data quality issues are questionable, high dollar-loss incidents and questionable, high numbers of fire deaths. Quarterly, USFA staff queries the database for questionable values (i.e., outliers) and verifies the values with state- and local-level NFIRS program managers. The data quality steps are important to ensure that the data meet the USFA's 3 criteria before the data are released in the NFIRS PDR format.

The USFA published the report "Review and Assessment of Data Quality in the National Fire Incident Reporting System," (May 2017). This document covered a review of the system, the many robust data quality checks and mechanisms which are an integral part of the NFIRS, and an assessment of the data quality both at the state level and at the data element level. The data element assessment focused on the most common data elements used in NFIRS data analyses. NFIRS data were reviewed from the 3 most recent years available at the time of the report's development (2009 to 2011). The "Review and Assessment of Data Quality in the National Fire Incident Reporting System" document is available at https://www.usfa.fema.gov/downloads/pdf/publications/nfirs_data_quality_report.pdf.

Unknown entries, incomplete loss reporting and unreported data are also important considerations when assessing NFIRS data quality. These topics are discussed in more detail in USFA's *Fire in the United States 2008-2017* (20th Edition) report available at: <https://www.usfa.fema.gov/downloads/pdf/publications/fius20th.pdf>.

See also: NFIRSgram: Data Quality
(<https://www.usfa.fema.gov/nfirs/coding-help/nfirsgrams/nfirsgram-data-quality.html>).

NFIRS Data in Public Data Release Format

NFIRS 5.0 provides 11 modules that recognize the increasingly diverse activities of fire departments today. These modules, together, contain 567 data elements. The data from these modules (except for the Apparatus and Personnel modules, which are not released) are presented in the Public Data Release (PDR) files. 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. The relationship between NFIRS modules and PDR files is shown in the following table.

No.	Module	Description	PDR Files
1	Basic Module	General information for each incident	Basic Incident Incident Address Basic Aid
2	Fire Module	Fire incident information	Fire Incident
3	Structure Fire Module	Information on structure fires	Fire Incident
4	Civilian Fire Casualty Module	Fire-related injuries or deaths to civilians	Civilian Casualty
5	Fire Service Casualty Module	Injuries or deaths to firefighters	Firefighter Casualty Firefighter Equipment Failure
6	EMS Module	EMS incidents	EMS
7	Hazardous Materials Module	Hazardous materials incidents	Hazmat Hazmat Chemical Hazmat Equipment Involved Hazmat Mobile Property
8	Wildland Fire Module	Wildland or vegetation fires	Wildlands
9	Apparatus/Resources Module	Apparatus-specific information	Not Included in PDR
10	Personnel Module	Personnel associated with apparatus	Not Included in PDR
11	Arson Module	Intentionally-set fire information	Arson Arson Agency Referral Arson Juvenile Subject

The PDR also includes additional files that do not correspond directly to a single NFIRS module.

- **FD Header:** This file contains records for each fire department, including the state and fire department identification number (FDID) as well as the address, number of stations, and number of personnel. It is possible for a fire department to have an entry in the FD Header file but not have any records in the PDR.
- **Code Lookup:** This file provides all the definitions for all codes used in the NFIRS and can be cross-referenced to the main files by file name and field name.

Finally, the Structure Fire Cause file is distributed with the PDR, but is not included in the same folder with the other files.

- **Structure Fire Cause:** This file contains the determined cause codes (primary, main, and general causes) for structure fires.

Data from the modules are grouped together each calendar year to create the PDR files in delimited text (.txt) format, which are then released annually into the public domain. For NFIRS data submitted prior to 2012, the PDR files were released in dBASE (.dbf) 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 data structure of the PDR files has been considerably simplified from the production database's schema for ease of use.

The PDR files from 2004 to 2013 only include fire and hazmat incidents and their related data tables. Prior to 2004, all incidents were included in the PDR files. Beginning with the 2014 NFIRS data, both the fire and hazmat incident PDR file (CD) and the full, all-incident PDR file (DVD) are available upon request from USFA's National Fire Data Center. Additionally, downloadable NFIRS PDR files from 1980 to 2020 are available at: <https://www.fema.gov/about/openfema/data-sets/fema-usfa-nfirs-annual-data>.

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. Every NFIRS incident has a record in the BasicIncident.txt file and depending on the type of incident or the circumstances of the event may have records in additional files. All other data tables (e.g., 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). Beginning in 2019, the PDR files include a preset identification key (INCIDENT_KEY) that is a single field that uniquely identifies each record. As a result, the data can be imported directly into an existing relational database with established referential integrity.

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 occurred in the same incident.

The PDR files are carat-delimited text files and can be read using SQL, Microsoft Access, or statistical software packages such as SAS, SPSS, or R. Microsoft Excel is not recommended as it does not have the capability to support very large datasets and will result in the truncation of data that exceed 1 million rows. For NFIRS data submitted prior to 2012, the PDR files were released in dBASE (.dbf) format.

The PDR files were originally created on the Windows platform and use Latin-1 encoding. Analysts using non-Windows environments should specify Latin-1 encoding when reading the files. Some fields contain characters that are unreadable using other encoding such as UTF-8.

Many data elements in the NFIRS have a Data Type of "C" indicating that the values are codes. Note that many code values include leading zeroes, so care should be taken upon import to ensure that these are not discarded.

Data Excluded from the PDR

Certain data fields collected by the NFIRS are not released in the PDR at the national level. This includes the data fields from the Apparatus/Resources and Personnel Modules, as well as the Remarks field and fields pertaining to special studies. In addition, fields that contain personally identifiable information such as name (e.g., Person/Entity Involved, Property Owner) are excluded from the PDR for privacy reasons.

Plus-one codes are codes that the local or state levels can use to record incident information in regionally specific detail. Where implemented, a plus-one code is one character longer than the NFIRS code. For example, one Actions Taken code in NFIRS is 11 (extinguishment by fire service personnel) and a local or state level plus-one code may be 112 (extinguishment with Compressed Air Foam System). The plus-one codes are not necessarily consistent from one department to another and are not used in national level analyses. In the PDR, a plus-one code of 112 would be truncated to 11. However, removal of the plus-one codes may lead to inadvertent duplication in multiple-entry fields, such as Actions Taken 1, 2, and 3. Analysts should examine their data for duplicates and remove them. See also: NFIRSGram: the use of plus-one codes (<https://www.usfa.fema.gov/nfirs/coding-help/nfirsgrams/nfirsgram-plusone-codes.html>).

NFIRS Analytic Resources

Several resources are available that provide more detailed documentation on using the NFIRS and the NFIRS data. The “National Fire Incident Reporting System Complete Reference Guide” (https://www.usfa.fema.gov/downloads/pdf/nfirs/NFIRS_Complete_Reference_Guide_2015.pdf) provides both instructions for reporting data to the NFIRS and an understanding of the data elements collected by the system. It also serves as a reference for coding the data. This document is also available on the PDR file.

The document “National Fire Incident Reporting System Version 5.0 Fire Data Analysis Guidelines and Issues” discusses analytic considerations and methods of analyzing fire-incident data using the NFIRS data. Topics include the NFIRS 5.0 data structure, general quality assurance issues, and definitions and parameters of common fire analyses (e.g., residential building fires or casualties), including the methodology for determining structure fire causes. The methods, techniques and considerations discussed are those used by the USFA analysts, and they do not necessarily reflect methods, techniques and considerations used by fire data analysts from other agencies and organizations. NFIRS data partners may (and do) employ their own methods for analyzing the data and may make differing assumptions when encountering data issues (http://www.usfa.fema.gov/downloads/pdf/nfirs/nfirs_data_analysis_guidelines_issues.pdf).

This document is also available on the PDR.

As previously noted, “The National Estimates Approach to U.S. Fire Statistics” is the original methodology for creating estimates of the U.S. fire problem using the NFPA’s annual Survey of Fire Departments for U.S. Fire Experience and NFIRS data. The authors present a detailed

consensus procedure for such calculations and the supporting rationale.⁷ “National Estimates Methodology for Building Fires and Losses” is the USFA’s application of the national estimates approach to building fires and fire losses. It details the USFA’s current fire data estimation methodology for all building fires (i.e., residential and nonresidential) and associated losses (http://www.usfa.fema.gov/downloads/pdf/statistics/national_estimate_methodology.pdf).

The USFA’s “Fire in the United States 2008-2017” is a statistical portrait of the national fire problem and provides an in-depth discussion of the data sources and the methodologies used to incorporate these data into fire analyses (<https://www.usfa.fema.gov/downloads/pdf/publications/fius20th.pdf>).

Lastly, the “Fire Data Analysis Handbook (3rd Edition, November 2021)” is a resource for those unfamiliar with basic data analysis techniques and their applicability to fire-data based analyses (<http://www.usfa.fema.gov/downloads/pdf/publications/fa-266.pdf>).

⁷ Hall, J. & Harwood, B. (1989, May). The National Estimates Approach to U.S. Fire Statistics. *Fire Technology*, 25 (2), 99–113 (<https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/NFPA-estimates-and-methodology/NationalEstimatesApproach.pdf>).