

## Introduction

In rural communities, volunteer fire companies have a critical role in maintaining public safety. To better understand their activities, the Center for Rural Pennsylvania examined 3 years of data (2015 to 2017) from the National Fire Incident Reporting System (NFIRS). This database contains more than 31,200 fire and hazardous incidents to which Pennsylvania’s rural and urban volunteer fire companies and combination paid/volunteer fire companies responded.

The Center used these data to develop an overview of Pennsylvania’s 1,657 volunteer and combination paid/volunteer fire companies and the types of incidents to which they responded. The Center also used the data to analyze the similarities and differences between rural and urban fire companies and the various types of incidents occurring in Pennsylvania.

Turn to Page 2 for a full description of the data source and the methodology used in this analysis.

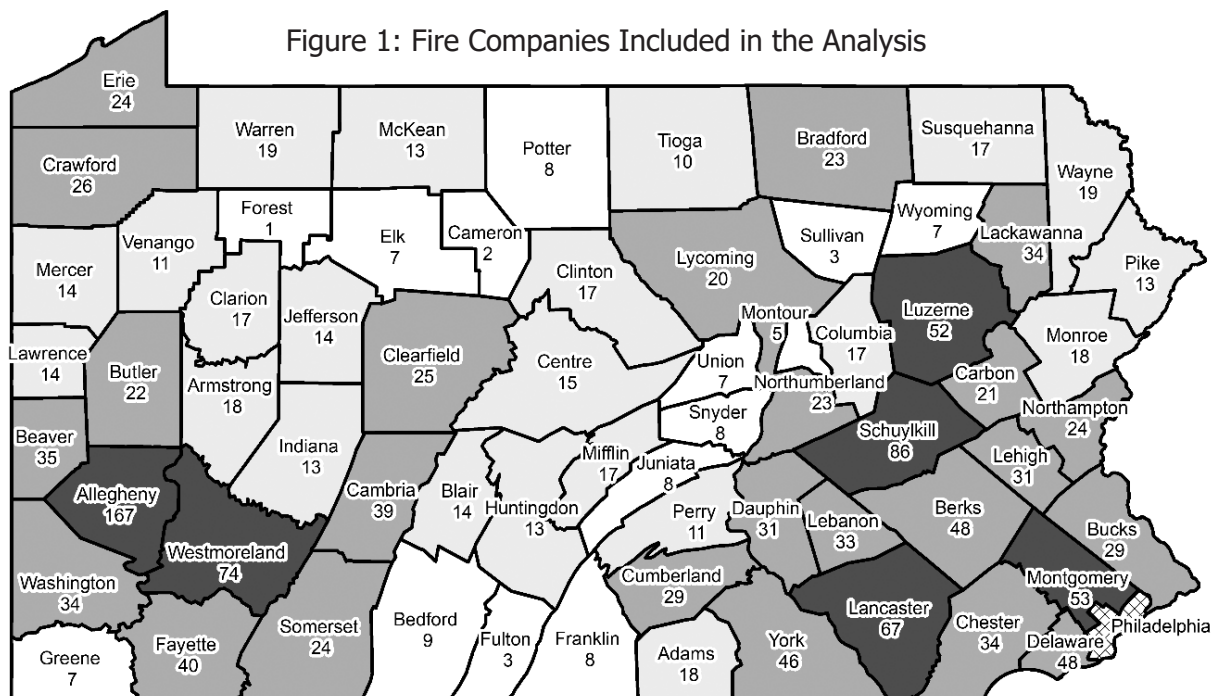
## Overview of Rural and Urban Fire Companies

Of the 1,657 fire companies included in this analysis, 798, or 48 percent, were in rural counties, and 859, or 52 percent, were in urban counties.

Among the rural companies that reported membership information, 97 percent were all-volunteer companies, and 3 percent were a combination of paid and volunteer companies. On average, these rural companies had 36 members.

Among the urban companies that reported membership information, 93 percent were all-volunteer companies, and 7 percent were a combination of paid and volunteer companies. On average, urban companies had 40 members.

Figure 1: Fire Companies Included in the Analysis



**Total Number of Fire Companies included in Analysis = 1,657**

<10 Fire Companies    
  10 to 19 Fire Companies    
  20 to 49 Fire Companies    
  50+ Fire Companies    
  No Fire Company Included in Analysis

## Data Source and Methods

### Data Source

This analysis used data from the 2015, 2016, and 2017 National Fire Incident Reporting System (NFIRS) public release data files, Basic Module. This is a voluntary reporting system used by fire departments and companies across the U.S. The database is maintained by the Federal Emergency Management Agency's U.S. Fire Administration. Information about each incident is entered by individual fire companies.

NFIRS collects data in 11 data modules that look at specific aspects of fire incidents, such as arson, personnel, and apparatus used. The basic module contains general information for each reported incident.

### Methods

In this analysis, only rural and urban volunteer and combination fire companies (paid/volunteer) were examined (definition below).

To obtain a more consistent picture of the number and type of fire and hazardous incidents that Pennsylvania rural and urban companies respond to, the Center used 3 years of data, 2015, 2016, and 2017, which were aggregated into a single database. This was done to avoid yearly fluctuations and single-year spikes.

In addition, each line of data in the database represents a fire and hazardous incident. The NFIRS guidelines recommend excluding companies that provided mutual aid: doing so avoids double counting incidents that may be reported by two or more companies. The one exception to this rule is for companies that reported firefighter casualties.

### Data Limitations

Because participation in NFIRS is voluntary, the database is not a complete count of all reported fire and hazardous incidents nor is it a survey, based on a statistically selected sample. Therefore, this analysis should not be considered a complete inventory or a

representative sample of fire and hazardous incidents.

This analysis does not include all incidents to which fire companies responded. The NFIRS data for Pennsylvania include only fire and hazardous conditions (see definitions).

### Definitions

**Rural and urban fire companies:** Fire companies located in rural counties were classified as rural and those in urban counties were classified as urban. The county classification was based on a combination of fire company identification codes and ZIP codes. The 31 fire companies without such codes or addresses were excluded from the analysis.

**Types of fire companies:** In this analysis, only volunteer and combination paid/volunteer fire companies were included. Paid companies were excluded. The determination of company type was based on the number of paid members and volunteers. Paid companies had only paid members, volunteer companies had only volunteer members, and combination companies had both paid and volunteer members. Companies that did not report their membership were checked against a list of paid companies provided by the Pennsylvania Fire and Emergency Services Institute.

**Apparatus and personnel:** Companies that failed to report the number of apparatus and/or personnel sent to the incident were excluded from this analysis. The analysis includes only those companies that reported both the number of apparatus and the number of personnel responding to the incident.

**Alarm to arrival time:** The time it took the fire company to respond to an incident was calculated by subtracting the arrival time from the alarm time. Any fire company that took 500 minutes or more (more than 8 hours) to arrive at the incident was excluded from the analysis.

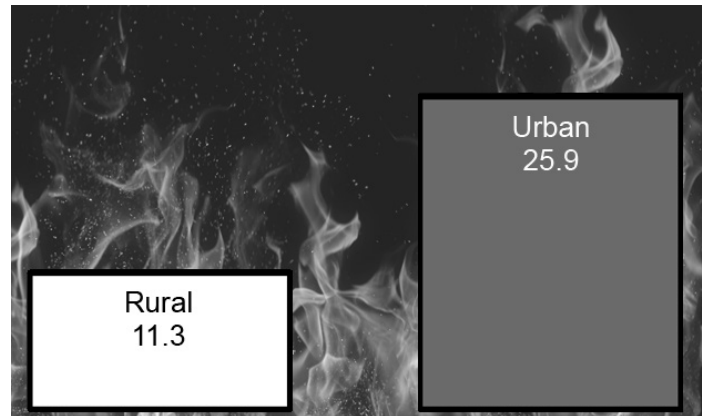
**Fire and hazardous incidents:** The incidents in the box at left were included in the analysis. It is unknown what percentage these incidents represent of the total number of incidents to which fire companies responded. For simplicity, all fire and hazardous incidents were referred to as fire incidents.

Fire	Hazardous Incidents (No Fire)
Structure Fire	Combustible/flamable spills and leaks
Fire in mobile property used as fixed structure	Chemical releases, reactions, or toxic conditions
Mobile property fire (vehicle fire)	Radioactive conditions
Natural vegetation fire (forest fire)	Electric wiring/equipment problems
Outside rubbish fire	Biological hazard
Special outside fire	Accident, potential accident (vehicle crashes)
Cultivated vegetation fire (crop fire)	Explosive, bomb removal
Unauthorized burning	Attempted burning, illegal action
Controlled burning	Other hazardous conditions
Other types of fires	

Figure 2: Average Annual Number of Rural and Urban Fire Incidents, 2015 to 2017

### Average Number of Fire Incidents

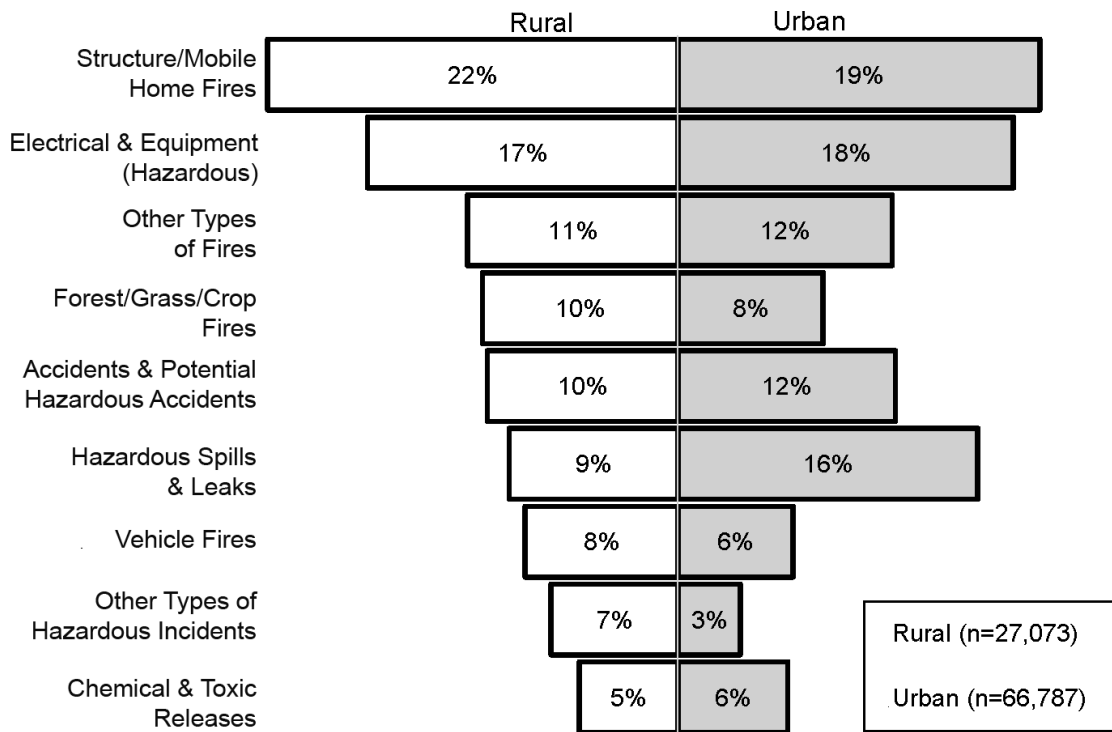
From 2015 to 2017, there was a statewide annual average of 31,287 fire incidents reported to NFIRS. Twenty-nine percent of these incidents were in rural counties, and 71 percent were in urban counties. On average, rural fire companies had 11.3 incidents per year and urban companies had 25.9 incidents per year.



### Types of Incidents

Among the types of incidents to which rural fire companies responded, 52 percent were fires, and 48 percent were spills, toxic releases and other hazardous incidents. Among all incidents for urban fire companies, 55 percent were spills, toxic releases and other hazardous incidents, and 45 percent were fires. False alarms were excluded from the dataset.

Figure 3: Types of Rural and Urban Incidents, 2015 to 2017



## Personnel and Apparatus Response

On average, rural companies sent 5.5 firefighters (fire suppression personnel) and 1.8 fire trucks to an incident, and urban companies sent 6.6 firefighters and 2.3 fire trucks to an incident.

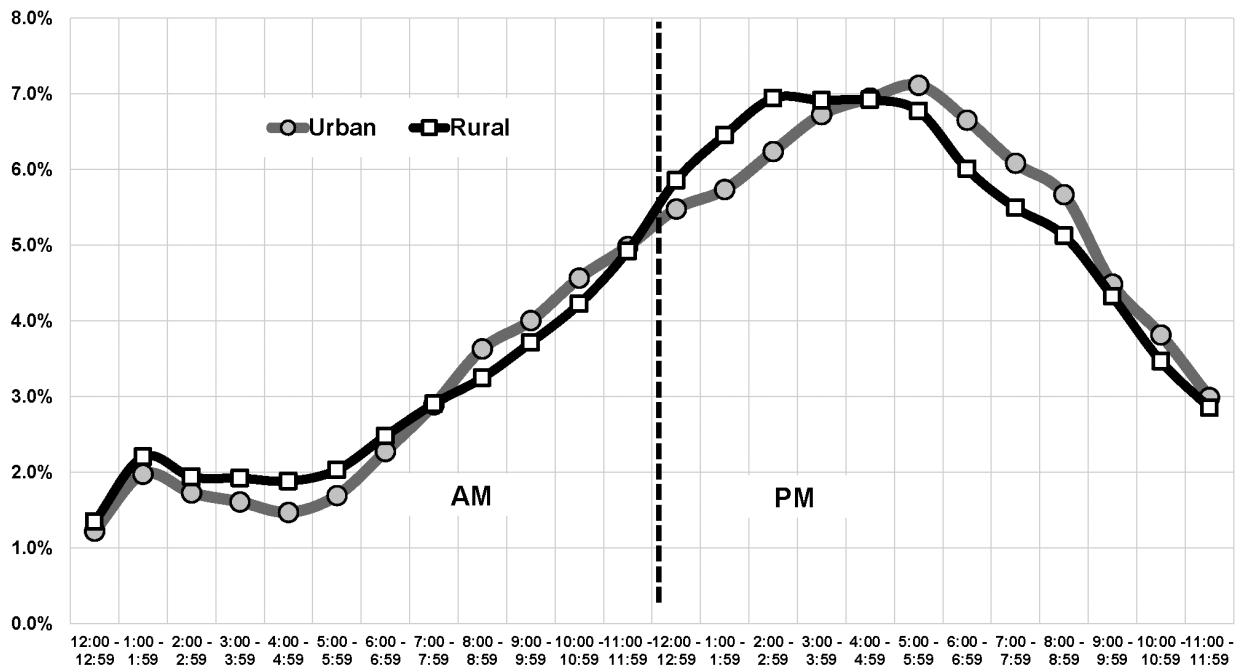
Figure 4: Average Number of Rural and Urban Fire Personnel and Apparatus Responding to Incidents, 2015 to 2017



## Time of Incidents

In both rural and urban areas, most fire alarms (56 percent in each) occurred during traditional daytime work hours of 8 am to 5 pm. The fewest number of fire alarms occurred between midnight and 5:59 am.

Figure 5: Time of Alarm Received by Rural and Urban Fire Companies, 2015 to 2017



For rural companies, the fewest number of firefighters responded to alarms that occurred between 6 am and 11:59 am (4.8 firefighters, on average).

Figure 6: Average Number of Rural and Urban Firefighters Responding to Incidents by Time of Day, 2015 to 2017

	Rural Firefighters (Avg. #)	Urban Firefighters (Avg. #)
Midnight to 5:59 am	5.6	6.3
6 am to 11:59 am	4.8	5.5
Noon to 5:59 pm	5.3	6.4
6 pm to 11:59 pm	6.2	7.7
Total	5.5	6.6

Spring (March, April and May) is the busiest time for both rural and urban fire companies, as 30 percent of rural and 28 percent of urban incidents occurred during these 3 months. The least busy time was fall (September, October, and November) when 22 percent of incidents occurred in both rural and urban areas.

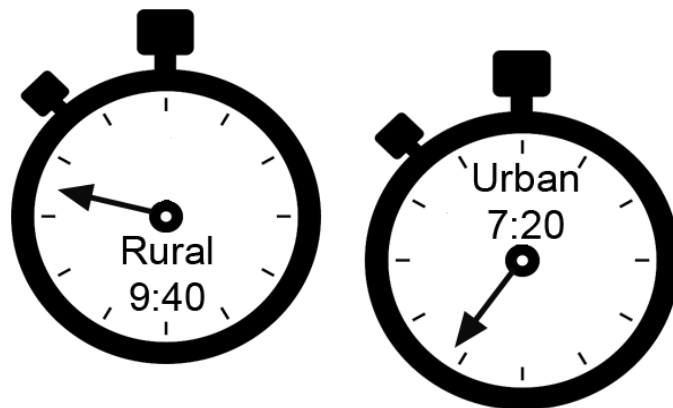


### Incident Response Times

Incident response time is the time the fire company receives an alarm until the time when the first unit (fire truck or other emergency vehicle) arrives on scene. On average, rural companies responded in 9 minutes 40 seconds and urban companies responded in 7 minutes 20 seconds. (Information on the distance from the fire company to the incident is not readily available.)

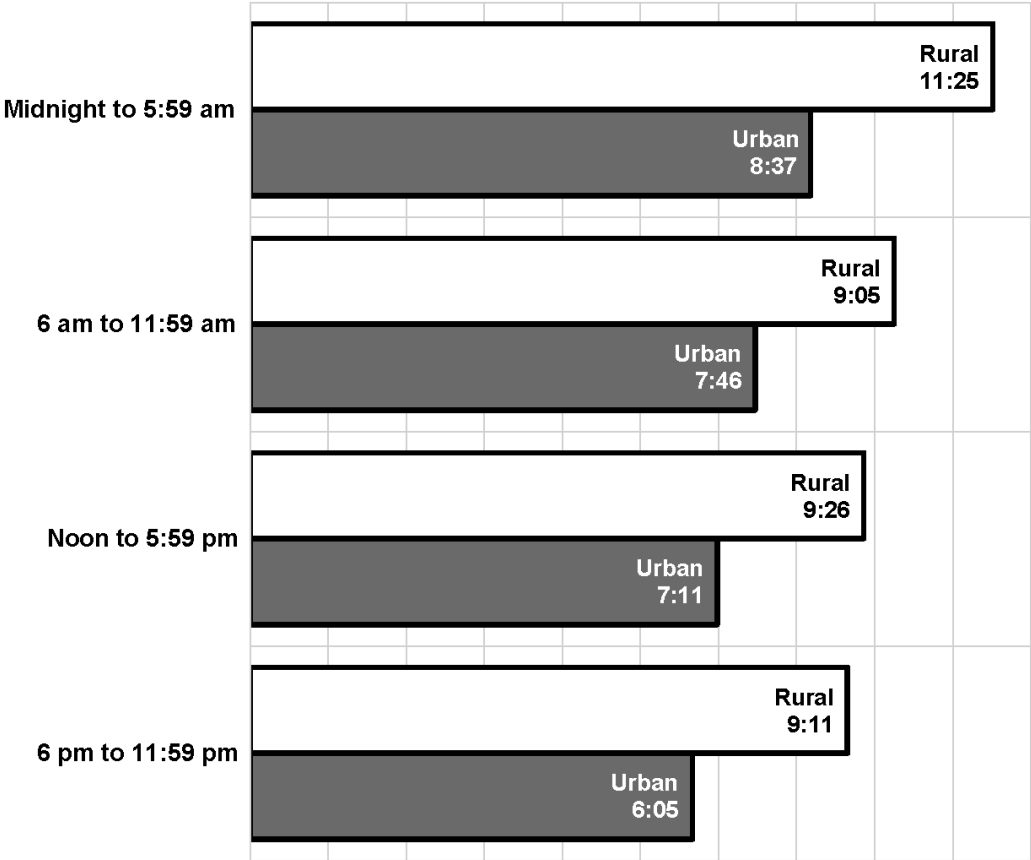
Figure 7: Average Alarm Response Times, in Minutes, 2015 to 2017

*(Time from when call was received to when the first unit arrived at the scene.)*



For both rural and urban companies, the more personnel that responded, the quicker the response time. For example, rural companies that had fewer than five people respond to the alarm had an average response time of 10 minutes 2 seconds, while those that had 15 or more people respond had an average response time of 7 minutes 53 seconds.

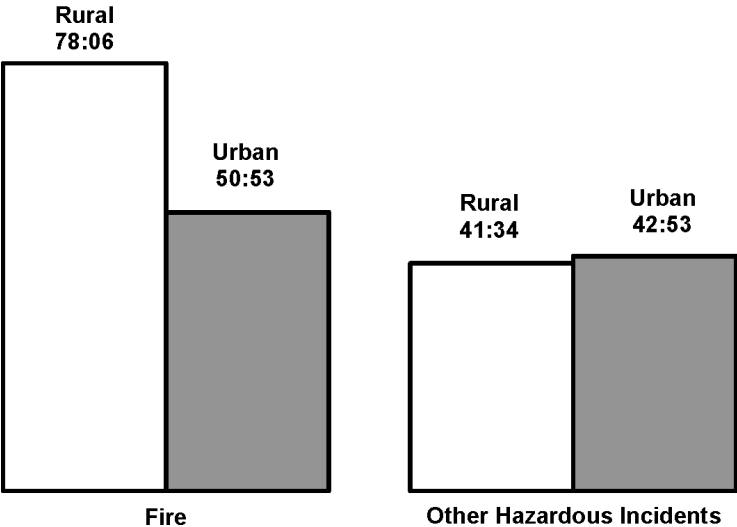
Figure 8: Average Response Time, in Minutes, by Time Call Was Received, 2014 to 2017



**Time at Incident Site**

Rural fire companies, on average, are on the incident site for a little more than 1 hour (60 minutes 33 seconds). On average, urban fire companies are on the scene for 46 minutes 28 seconds. This time is calculated from when the first unit arrives at the site until the last unit leaves. There are significant differences in the time at the site and the types of incidents. For fires, rural companies spent more than 78 minutes on scene: for other types of incidents, they spent nearly 42 minutes. For urban companies, the average time was a little less than 51 minutes for fires, and 43 minutes for other hazardous incidents.

Figure 9: Average Time Spent at Incident Site (First unit arrival at incident to last unit leaving incident, in minutes)



## Firefighter Injuries and Deaths



According to the NFIRS data, two firefighters, one rural and one urban, were killed on duty from 2015 to 2017. Nationwide during this same period, 137 volunteer firefighters died while on duty. During this same period, 126 rural and 449 urban firefighters were injured. On average, rural fire companies had 4.7 deaths or injuries per 1,000 fire alarms, and urban fire companies had 6.7 deaths or injuries per 1,000 alarms.

## Property Loss from Fires

The majority of rural (96 percent) and urban (95 percent) fire companies did not report the value of property losses in the database. Among the companies that reported a property loss value of \$1 or more, rural companies reported a median loss of \$10,000, and urban companies reported a median loss of \$5,000.

Figure 10: Estimated Property Loss from Fires in Rural and Urban Pennsylvania, 2015 to 2017  
(Includes only incidents where property loss was reported as \$1 or more)

<b>Rural</b> (n=1,094 incidents)	<\$5,000 33%	\$5,000 to \$9,999 15%	\$10,000 to \$49,999 27%	\$50,000+ 25%
<b>Urban</b> (n=3,564 incidents)	<\$5,000 45%	\$5,000 to \$9,999 12%	\$10,000 to \$49,999 24%	\$50,000+ 19%

## Conclusions

Differences between rural and urban fire companies: In general, rural companies had fewer members, responded to fewer alarms, and had longer response times than urban companies. Also, rural companies responded to more fire incidents than hazardous incidents and urban companies responded to more hazardous incidents than fire incidents. For rural companies, lower membership and number of alarms, and longer response times could be attributed to larger geographic service areas and lower population densities.

Similarities between rural and urban fire companies: For both rural and urban fire companies, most alarms occurred in the afternoon and during the spring season. Also, both types of companies remained at incident sites for roughly the same amount of time.

Overall, fire companies respond more to hazardous incidents than fires: Statewide, about 53 percent of alarms were for hazardous incidents, such as gasoline spills and downed power lines. Fires accounted for 47 percent of all alarms. This means that firefighters must be trained to meet a wide variety of incidents, which takes time and money, and can cause financial hardships for smaller volunteer fire companies.

Response during work hours is challenging: About 56 percent of all alarms occurred between 8 am and 5 pm. During these traditional daytime work hours, fire companies have the fewest number of firefighters and other personnel who respond to incidents. Responding to alarms during these hours will likely be an on-going challenge for many volunteer fire companies.

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