



RESEARCH

Service or Gas Station Fires

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Key Findings

During the five-year period of 2014 through 2018, local fire departments responded to an estimated average of 4,150 fires in or on service or gas station properties per year. These fires caused an average of three civilian deaths, 43 civilian fire injuries, and \$30.0 million in direct property damage annually.

The estimated 4,370 reported service station fires in 2018 was 44 percent lower than 7,860 in 1980. However, the 2018 estimate was the highest since 2008.

From 2014 through 2018, an average of 550 structure fires (13 percent) per year caused an average of one civilian death, nine civilian injuries, and \$11.1 million (37 percent) in direct property damage annually.

The leading cause of structure fires at these properties, electrical distribution and lighting equipment (21 percent), caused more than half (55 percent) of the structure fire property damage. Cooking caused 19 percent of the structure fires but only 7 percent of the associated loss.

Only 4 percent of structure fires at service stations began with the ignition of gasoline. Some type of gas, including natural gas, LP-Gas, acetylene, and unclassified gas, was first ignited in 5 percent of the structure fires. It is possible that the category of unclassified gas might have been used to describe gasoline in some incidents.

A disproportionate share of structure fire property damage resulted from fires that began in or on exterior walls, maintenance or paint shops, and garages or other vehicle storage areas.

More than half of the fires (56 percent) at these properties were vehicle fires. The 2,340 vehicle fires per year caused an average of one civilian

death, 26 civilian injuries, and \$11.0 million (37 percent) in direct property damage annually.

The 2018 estimate of 2,470 vehicle fires on these properties was 27 percent higher than the 1,940 such fires in 1980. Vehicle fires at these properties peaked in the mid- to late-1990s and early 2000s.

Three-quarters of the vehicle fires in 2014 through 2018 were caused by either mechanical failures or malfunctions, or electrical failures or malfunctions, a somewhat larger share than of highway vehicle fires overall.

Although 20 percent of vehicle fires at service stations began with the ignition of gasoline, only 2 percent started at the fuel tank or fuel line, and 3 percent began on the vehicle's exterior surface. This suggests that refueling was not a frequent cause of these fires.

The 670 non-rubbish outside and other fires (16 percent) per year caused an average of one civilian death, four civilian injuries, and \$7.6 million in direct property damage. More than half of these fires were vegetation fires.

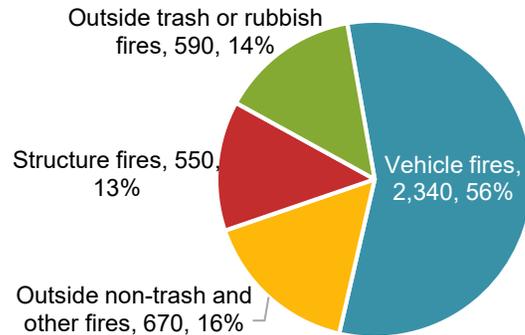
One-quarter (24 percent) of the non-rubbish outside and other fires were started by smoking materials. Another 23 percent were started by electrical distribution and lighting equipment. Although not in the top tier of causes, some type of pump was involved in 7 percent of these fires.

The 590 (14 percent) outside trash or rubbish fires per year on these properties caused less than one civilian death, three civilian injuries and \$0.2 million in direct property damage annually. Thirty-eight percent of these 590 fires were intentional.

Fires at US Service or Gasoline Stations

During the five-year period of 2014 through 2018, local fire departments responded to an estimated average of 4,150 fires in or on service or gas station properties per year. These fires caused an annual average of three civilian deaths, 43 civilian fire injuries, and \$30.0 million in direct property damage. Figure 1 shows that more than half of the fires (56 percent) were vehicle fires. More detail will be provided about each type of fire.

Figure 1. Service station fires by incident type 2014–2018 annual averages

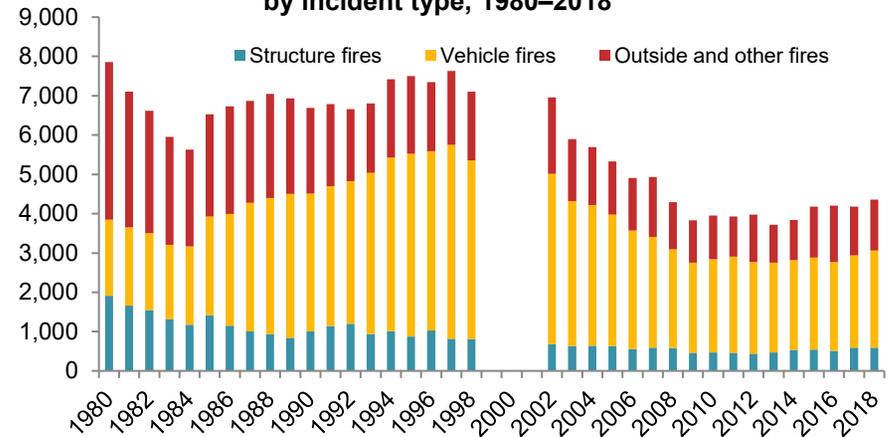


Estimates of fires were derived from the detailed information compiled by the U.S. Fire Administration’s National Fire Incident Reporting System (NFIRS) and NFPA’s annual fire experience survey. Fires involving fuel dispensing pumps might be classified as structure fires, outside or other fires, or possibly vehicle fires if a vehicle was involved. Pumps are identified by an NFIRS equipment involved in ignition code and not restricted to fuel dispensing pumps. Caution should be used in interpreting the results. Many types of fires, such as vehicle fires while parked and vegetation fires, occur on many different types of property.

Trends

The estimate of 4,370 reported service station fires in 2018 was 44 percent lower than the 7,860 such fires in 1980. However, the 2018 estimate was the highest since 2008. Version 5.0 of NFIRS was first introduced in 1999 and gradually adopted by fire departments around the country. Estimates for the transition years of 1999 through 2001 are more volatile and should be viewed with caution. They are shown in the [supporting tables](#) but not in Figure 2.

Figure 2. Reported fires at service stations by incident type, 1980–2018

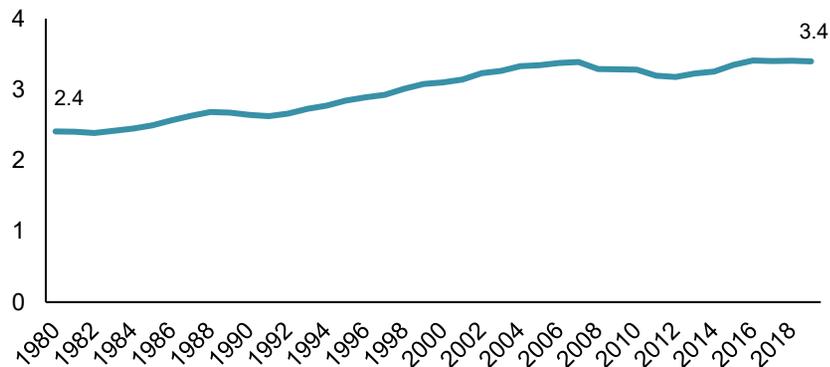


The 2018 estimates of service station structure, outside, and other fires (including outside rubbish) were roughly two-thirds lower than in 1980 (estimates of 590 structure fires and 1,300 outside fires or other fires, including outside rubbish, in 2018 vs. 1,910 structure fires and 4,010 outside or other fires in 1980). In contrast, the 2018 estimate of 2,470 vehicle fires on these properties was 27 percent higher than the 1,940 such fires in 1980. Vehicle fires at these properties peaked in the mid- to late-1990s and early 2000s.

Data from the US Energy Information Administration shows that roughly 1.4 times as much motor gasoline was produced in recent years as in 1980.¹ See Figure 3.

Rubeis, Groves, Portera, and Bonaccorsi of the Boston Consulting Group described the challenges facing the service station industry.² Increasing usage of electricity and other non-traditional vehicle fuel or power sources will reduce the demand for gasoline. Ride-hailing services and autonomous vehicles will reduce individual vehicle ownership. They propose making service stations a multipurpose destination.

Figure 3. Billions of barrels of motor gasoline produced by year



Source: US Energy Information Administration

According to the US Census Bureau, 87 percent of the 113,000 gasoline stations in the United States in 2017 had a convenience store on the premises.³ The multipurpose nature of these properties is evident in the structure fire causes.

Structure Fires

During 2014 through 2018, an estimated average of 550 structure fires in or on service station properties per year caused an average of one civilian death, nine civilian injuries, and \$11.1 million in direct property damage annually.

Figure 4 shows that two-fifths of the structure fires at these properties were caused by a) electrical distribution or lighting equipment, or b) cooking. Cooking is more likely associated with the convenience store part of the property.

Figure 4. Leading causes of service station structure fires, 2014–2018

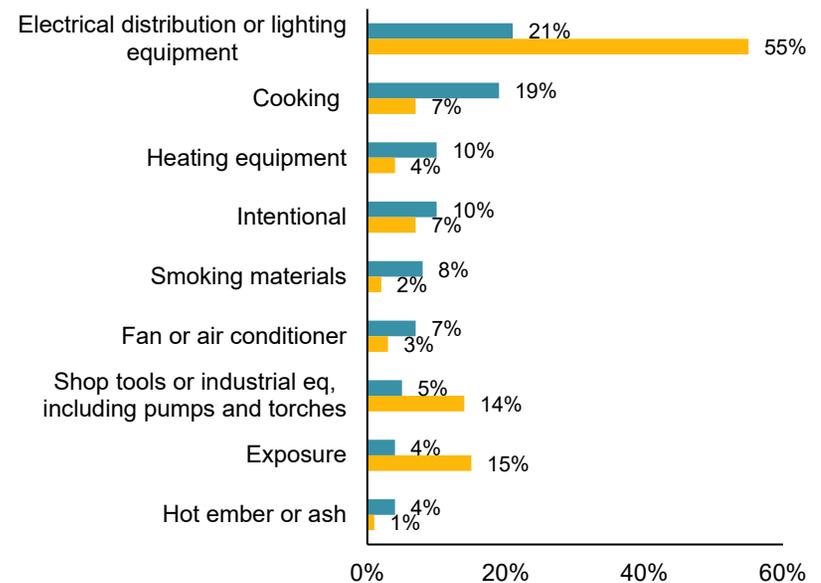
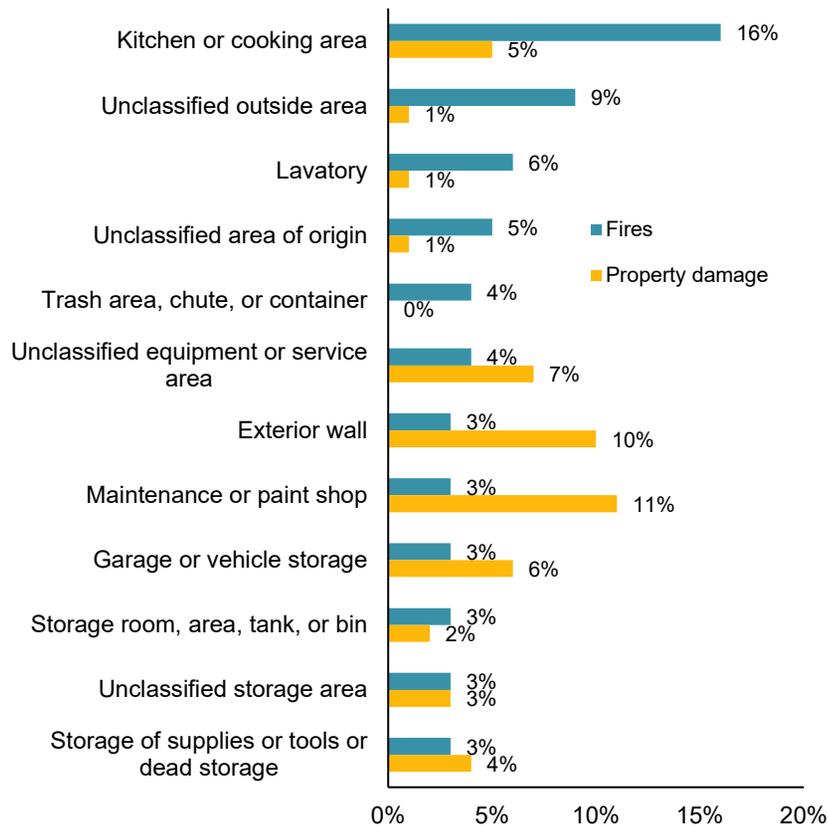


Figure 5 shows that a kitchen or cooking area was the most common area of origin for service station structure fires. Again, these are most likely in the associated convenience store.

NFIRS does not have specific area of origin codes that would identify the area of a service station. It is likely that some of these incidents were captured in unclassified outside areas, unclassified areas of origin, and unclassified service or equipment areas. Pumps, part of the shop tool or industrial equipment category, were identified as the equipment involved in 1% of the service station structure fires.

Figure 5. Leading areas of origin in service station structure fires: 2014–2018



A disproportionate share of the property damage was associated with fires that began in maintenance or paint shops, in or on the exterior wall, and in garages or vehicle storage areas. It is unclear how many service stations still perform vehicle maintenance. Figure 4 showed that shop tools, including torches, burners, or soldering irons, caused a disproportionate share of the property damage in service station structure fires. While electrical distribution and lighting equipment caused the largest share of direct property damage, these fires can occur in any area.

NFIRS has a separate occupancy category for motor vehicle or boat sales, services, or repair. During this period, the estimated 1,660 structure fires per year at such facilities caused an average of three civilian deaths, 54 civilian injuries, and \$121 million in direct property damage annually. The portion associated with sales cannot be separated out. It is possible that some fires in this category occurred in service station bays.

The 60 (11 percent) service station structure fires per year that began with the ignition of flammable or combustible liquids or gases, piping, or filters caused an average of \$2.3 million in direct property damage annually. Gasoline was identified as the type of material first ignited in 20 (4 percent) of the structure fires at these properties per year; some type of cooking oil, transformer, or lubricating oil was first ignited in 30 (6 percent); and some type of gas was also first ignited in 30 such structure fires annually.

While the NFIRS data elements for material first ignited and type of material first ignited are loosely related, the connection is not absolute. Cooking oil could be coded as a food or as a combustible liquid. Other leading materials and types of material first ignited are generally consistent with the leading causes and areas of origin.

Vehicle Fires

During 2014 through 2018, an estimated average of 2,340 vehicle fires on service station properties per year caused an average of one civilian death, 26 civilian injuries and \$11.0 million in direct property damage annually.

Three quarters of vehicle fires at service stations were caused by either mechanical failures or malfunctions (52 percent) or electrical failures or malfunctions (24 percent). This is a somewhat larger share than is seen for highway vehicle fires overall (47 percent mechanical and 21 percent electrical)⁴ but is generally consistent. Some type of operating equipment was the heat source in 70 percent of the service station vehicle fires. Only 1 percent of vehicle fires on these properties was intentional.

Around the turn of the century, the Petroleum Equipment Institute (PEI) began investigating reports of fires during refueling in dry weather that appeared to be started by static electricity. Readers of their newsletter were asked to report such incidents to PEI in January 2000. PEI received 176 such reports about incidents from 1992 through 2010.⁵ The same document noted that PEI had no documented incidents of refueling fires started by a cell phone. As part of their “Stop Static Campaign,” PEI cautioned consumers to never re-enter their vehicles while refueling. In a 2016 addendum to that campaign’s archival page, PEI notes that “The incidence of these static-related fires has declined dramatically with the adoption of onboard vapor recovery systems in passenger vehicles.” They had not received any new reports of such incidents since 2010.⁶

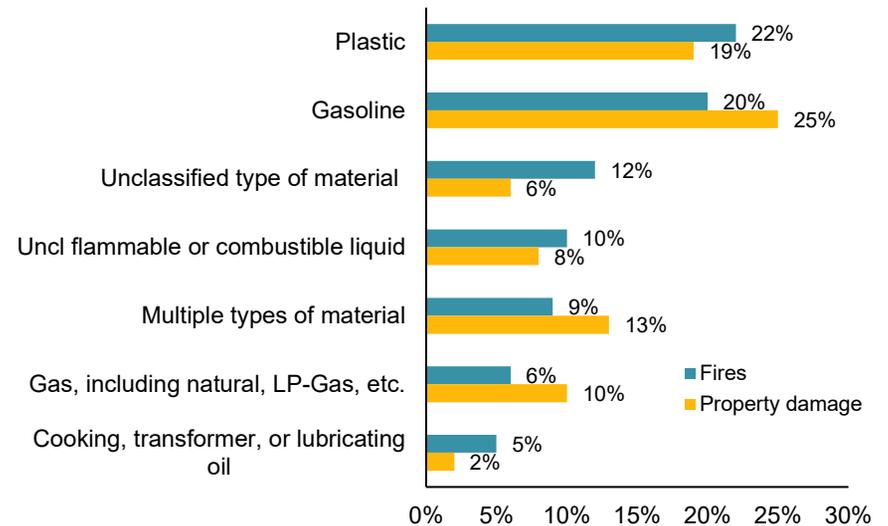
In 2004 through 2008, 3 percent of vehicle fires at service stations were started by an unclassified static discharge (regardless of activity).⁷ In 2014 through 2018, only 1 percent of the vehicle fires on these properties began in this matter.

Almost three-quarters (71 percent) of vehicle fires at service stations in 2014 through 2018 began in the engine, running gear, or wheel area; 7 percent began in the passenger area; 4 percent began in the cargo or trunk area; and 3 percent began on the exterior surface. Only 2 percent started at the fuel tank or fuel line. The small percentages associated with the exterior and fuel line suggest that the refueling process was not a major factor in these fires.

One-third (32 percent) of the vehicle fires at service stations began with the ignition of flammable or combustible liquids, gases, piping, or filters. Almost one third (31 percent) began with electrical wire or cable insulation, and 7 percent began with a tire.

Figure 6 shows the leading types of material that first ignited in vehicle fires at service stations. Only one in five such fires began with gasoline.

Figure 6. Leading types of material first ignited in vehicle fires at service stations, 2014–2018

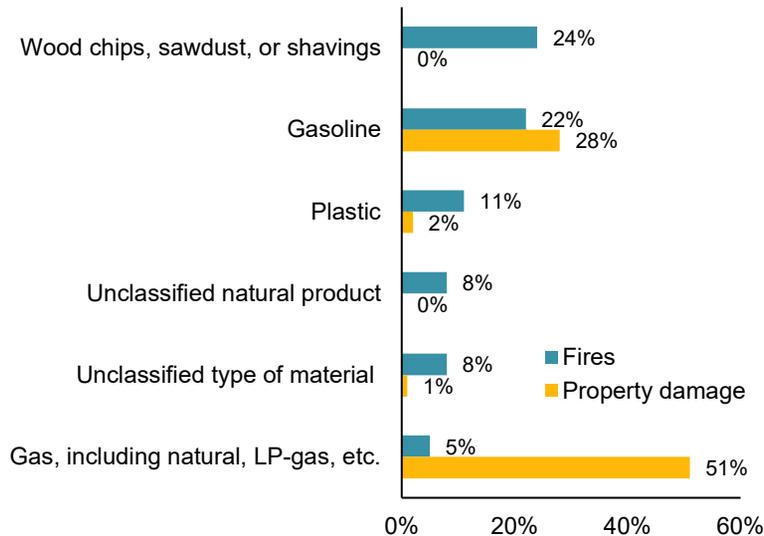


Outside and Other Fires (excluding trash or rubbish fires)

During 2014 through 2018, an estimated average of 670 non-structure, non-vehicle outside and or other fires (excluding trash or rubbish fires) at service station properties per year caused an average of one civilian death, four civilian injuries and \$7.6 million in direct property damage annually. These fires can occur on any part of the service station property.

More than half (55 percent) of non-rubbish outside or other fires had incident types indicating some type of natural or cultivated vegetation fire. Twelve percent were outside equipment fires, 4 percent were outside gas or vapor combustion explosions, 1 percent were outside storage fires, and 9% were unclassified special outside fires. Nineteen percent were “other” fires.

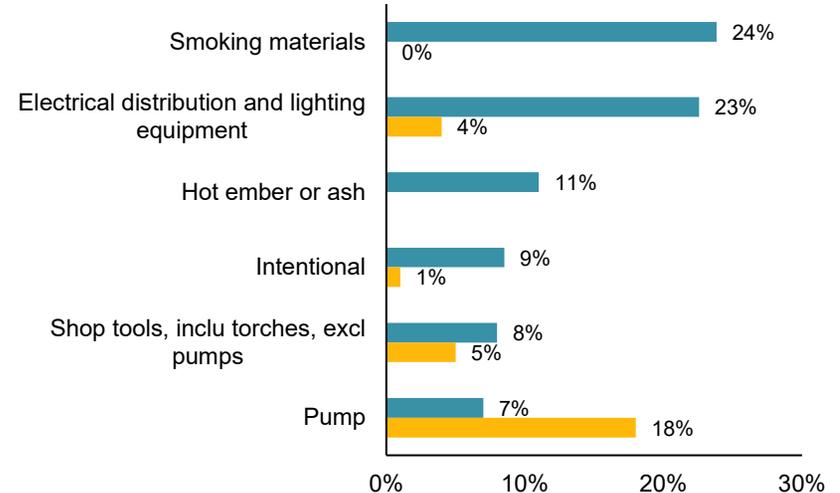
Figure 7. Leading types of material first ignited in non-rubbish outside and other service station fires 2014–2018



While vegetation and mulch-type materials were among the most common materials first ignited in these fires, Figure 7 shows that the highest percentages of property damage were seen in fires that began with the ignition of gasoline or gas. Most of the gas was coded as “flammable gas, other.” It is possible that some of these actually involved gasoline.

Figure 8 shows that roughly one-quarter of non-rubbish outside and other fires were started by cigarettes or other smoking materials (excluding matches and lighters). It is likely that some of the embers or ashes came from smoking materials, although that cannot be confirmed with the available data. Electrical distribution and lighting equipment was a leading cause of these fires and of the previously discussed structure fires. Pumps were a more common cause of these fires than of the other types of incidents.

Figure 8. Leading causes of non-rubbish outside and other service station fires, 2014–2018



Outside Trash or Rubbish Fires

During 2014 through 2018, an estimated average of 590 outside trash or rubbish fires at service station properties per year caused an average of three civilian injuries and \$0.2 million in direct property damage annually. Less than one death per year was reported in these fires.

Almost two of every five (38 percent) outside trash or rubbish fires were intentional, a much higher percentage than was seen with any of the other incident types.

For More Information

Individuals interested in keeping service stations safe from fire should consult *NFPA 30A - Code for Motor Fuel Dispensing Facilities and Repair Garages* for information about fire prevention in these properties.

Methodology

For more detailed information about the causes, circumstances, and trends related to fires in these properties, see *Fires in or at Service or Gas Stations Supporting Tables*.

The statistics in this analysis are estimates derived from the US Fire Administration's [National Fire Incident Reporting System \(NFIRS\)](#) and NFPA's annual survey of US fire departments. Fires reported to federal or state fire departments or industrial fire brigades are not included in these estimates. Only civilian (non-firefighter) casualties are included in this analysis.

Service or gas stations were identified by NFIRS property use code 571. Fires with the confined structure fire incident types (NFIRS incident type codes 113–118) were analyzed separately from the other NFIRS structure fire incident type codes (111–112 and 120–123). Results were summed. Outside non-rubbish and unclassified fires (NFIRS incident type codes 100, 140–149, and 160–199) and outside rubbish fires (NFIRS incident type codes 150–159) were also analyzed separately and summed. Vehicle fires were identified by NFIRS incident types 130–139.

Fires in which causal factors were unknown were allocated proportionally among fires with known data. For more information on the methodology used for this report, see "[How NFPA's national estimates are calculated for home structure fires.](#)"

Acknowledgments

The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the NFIRS and the annual NFPA Fire Experience Survey. These firefighters are the original sources of the detailed data that makes this analysis possible. Their contributions allow us to estimate the size of the fire problem.

We are also grateful to the US Fire Administration for its work in developing, coordinating, and maintaining the NFIRS.

To learn more about research at NFPA, visit [nfpa.org/research](https://www.nfpa.org/research).

Email: research@nfpa.org.

NFPA No. PKG15.

¹ US Energy Information Administration. “U.S. Product Supplied of Finished Motor Gasoline (Thousand Barrels)” released 8/31/2020. Accessed <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MGFUPUS1&f=A> September 29, 2020.

² Mirko Rubeis, Stuart Groves, Tony Portera, and Giuseppe Bonaccorsi. “Is There a Future for Service Stations?” July 12, 2019. Accessed at <https://www.bcg.com/publications/2019/service-stations-future> September 29, 2020.

³ U.S. Census Bureau, “Number of Firms, Number of Establishments, Employment, Annual Payroll, and *Preliminary* Receipts by Enterprise Employment Size for the United States, All Industries: 2017,” *2017 County Business Patterns and 2017 Economic Census*. Accessed at

https://www2.census.gov/programs-surveys/susb/tables/2017/us_6digitnaics_2017.xlsx September 25, 2020.

⁴ Marty Ahrens. *Vehicle Fires*. Quincy, MA National Fire Protection Association. 2020. Available at [nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/US-Fire-Problem/osvehiclefires.pdf](https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/US-Fire-Problem/osvehiclefires.pdf).

⁵ Robert N. Renkes. *Fires at Refueling Sites That Appear to be Static Related – Summary*. Tulsa, Oklahoma: Petroleum Equipment Institute. 2010. Accessed https://www.pei.org/sites/default/files/PDF/refueling_fire_incidents.pdf September 30, 2020.

⁶ Petroleum Equipment Institute. “The Latest,” July 2016. Accessed at <https://www.pei.org/static> September 30, 2020.

⁷ Ben Evarts. *Fires at US Service Stations*. Quincy, MA National Fire Protection Association. 2020, 25.