

U.S. Fire Administration TOPICAL FIRE RESEARCH SERIES

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Landfill Fires

FINDINGS

- Each year, an average of 8,300 landfill fires causes up to \$8 million in property loss. Few casualties result from these fires.
- Landfill fires are most prevalent in the spring and summer months, when there is a greater chance of spontaneous combustion.
- Landfill fires include not only refuse, but vehicles, structures, and surrounding brush and grass.
- Fires at discarded tire sites produce large amounts of oil and smoke and are difficult to contain and extinguish.
- Matches, open fire, and hot embers/ashes are the leading forms of heat ignition.
- The cause of more than half of landfill fires is not reported; 40% are attributed to arson.

Each year in the United States, an average of 8,300 landfill fires occur. These fires are responsible for less than 10 civilian injuries and between \$3 and \$8 million in property loss each year.¹ It is difficult to assign value to these fires as the refuse itself has little or no value. Approximately 30 firefighters are injured fighting landfill fires each year. No fatalities were reported to the National Fire Incident Reporting System (NFIRS) during the 1996–98 period.

Unlike the common definition a landfill that signifies a public or private area where waste is buried (commonly known as a municipal solid waste (MSW) landfill), the definition used by NFIRS encompasses not only MSWs, but general refuse disposal areas and dumps in open ground.

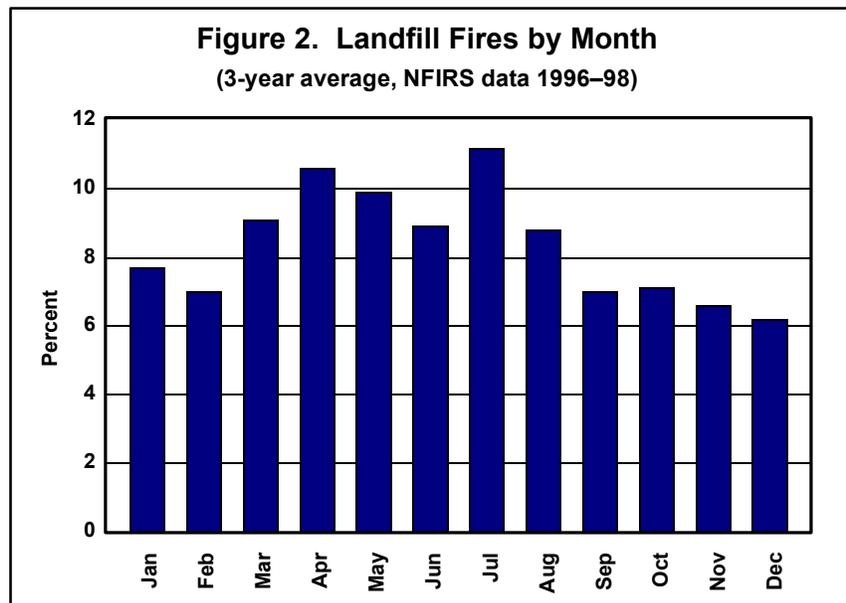
As shown in Figure 1, landfill fires account for a significantly lower amount of property loss when compared to the average of all fires. They also result in considerably less civilian casualties. This topical report examines the causes and characteristics of these fires.

Figure 1. Loss Measures for Landfill Fires
(3-year average, NFIRS data 1996–98)

LOSS MEASURE	ALL FIRES	LANDFILL FIRES
Dollar Loss/Fire	\$5,619	\$1,011
Civilian Injuries/1,000 Fires	15.7	1.0
Civilian Fatalities/1,000 Fires	2.4	0.02

WHEN FIRES OCCUR

Landfill fires are at their highest number from March through August (Figure 2), with July as the peak month. This is likely due to the hotter temperatures in these months, when there is a greater chance of spontaneous combustion and hot, smoldering discarded products igniting in landfills.



WHERE FIRES START

Not surprisingly, the majority of landfill fires involve refuse fires, 64% occurring in trash or rubbish containers. However, other fires do occur on landfills. Vehicle fires involve dump trucks, recycling trucks, and other vehicles that are commonly found in landfills. Another type of fire found in landfills is structure fires, possibly involving structures such as small offices commonly found on landfill sites. Other types of fires in landfills are tree, brush and grass fires that can occur when landfill fires spread to surrounding areas. The property losses by type of fire are listed in Figure 3.

Figure 3. Property Loss in Landfill Fires (\$ millions) (3-year average, NFIRS data 1996–98)	
TYPE OF LANDFILL FIRE	DOLLAR LOSS
Vehicle	\$4.2
Structure	\$2.5
Other	\$1.7

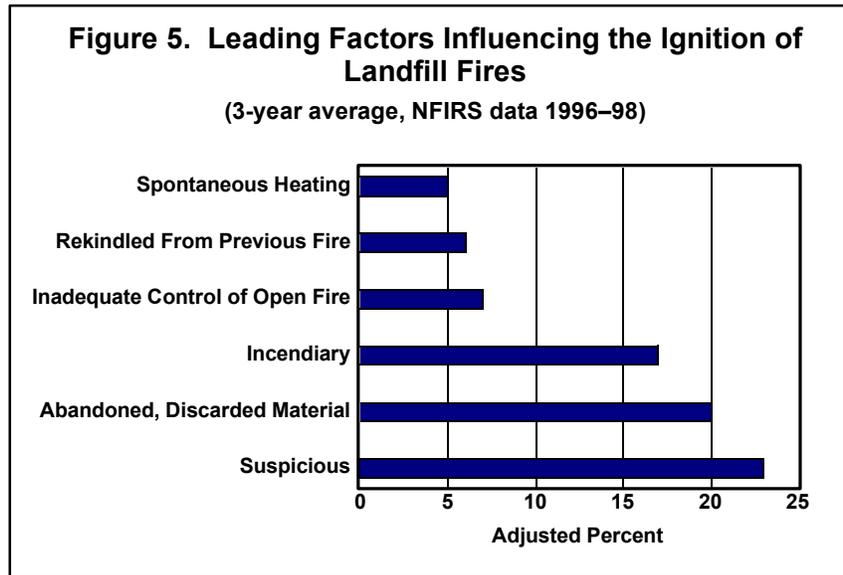
WHAT IGNITES FIRES

The leading form of heat ignition in landfill fires is matches (23%) (Figure 4). The second and third leading forms of heat ignition are open fire and hot embers and ashes (both 13%). Sometimes hot embers and ashes are discarded without the realization that the ashes are still slightly hot and fire could ensue.

Figure 4. Leading Form of Heat of Ignition in Landfill Fires (3-year average, NFIRS data 1996–98)	
FORM OF HEAT OF IGNITION	PERCENTAGE OF FIRES
Matches	23
Open Fires	13
Hot Embers, Ashes	13

FACTORS INFLUENCING THE FIRE'S IGNITION

Over half of the landfill fires reported to NFIRS have no information available as the primary ignition factor. This lack of information is not surprising and reflects challenges in pinpointing causes of landfill fires. Of the remaining fires, incendiary and suspicious origins (commonly referred to as arson) account for 40% (Figure 5).



Not unexpectedly, 20% of landfill fires are attributed to abandoned or discarded materials. Included are discarded matches, cigarettes, and the like, which may have been discarded while still smoldering. Also included are containers with flammable residues. Spontaneous heating is attributed to 5% of landfill fires. This occurs when underground, decomposing waste rising in temperature combusts as it comes in contact with a methane gas pocket. This is known as a “hotspot” and can be identified when white or brown smoke emanates from the surface of a landfill.

TIRE FIRES³

Tire fires pose a unique challenge to the fire service. Hundreds of millions of tires are discarded each year. These tires are stockpiled in dumps, landfills, and recycling facilities throughout the United States. When ignited, tires burn with a higher per-pound heat output than most coal; they also produce large amounts of oil and smoke, which can cause serious air and water contamination. Further, tire fires can be extremely difficult to contain and extinguish. Even after they are extinguished, tire fires can flare up again weeks, even months, later.

EXAMPLES

- On January 26, 1998, an employee at Richard DeCoite’s construction and demolition (C&D) landfill in Ma’alaea, Maui, noticed an odd odor, which led to the discovery of a fire 15 to 20 feet underground. Attempts were made to smother it with injections of more than 1,000 pounds of liquid carbon dioxide. The fire was eventually

deemed to be extinguished in a matter of weeks, although it continued to smolder for 4 months.⁴

- An underground landfill fire that was discovered in December of 1996 in Danbury, New Jersey, caused an unpleasant odor (which smelled like rotten eggs due to the high concentration of hydrogen sulfide in landfills). The odor spread into two surrounding neighborhoods. The fire lasted for weeks and the town was forced to install a gas recovery system, whose cost exceeded \$1 million.⁵

CONCLUSION

Landfill fires can be prevented, and property loss decreased, by further compacting waste so less air or methane pockets are formed. By checking to make sure material is properly extinguished (such as ashes, cigarettes) and that flammable and volatile materials are corrected disposed of, the number of landfill fires could decrease.

For more tips on how to prevent landfill fires in your state, see the USFA website: <http://www.usfa.fema.gov>, or contact your local fire department.

NOTES

1. National estimates are based on data from the National Fire Incident Reporting System (NFIRS) (1996–1998) and the National Fire Protection Association’s (NFPA’s) annual survey, *Fire Loss in the United States*.
2. Since civilian and firefighter deaths associated with landfill fires are rare and because this report represents statistical estimates based on a sample of fires, it is possible that the estimates reflect no deaths during a time period where a fatal fire occurred
3. *Scrap and Shredded Tire Fires Special Report*, Major Fires Investigation Project #93, FEMA, USFA, December 1998.
4. “Ma’alaea Landfill Fire Sparks State Effort To Develop Guidelines,” *Environment Hawai’i, Inc.*, Volume 9, Number 4, October 1998.
5. <http://www.newstimes.com>

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