

# HOME ELECTRICAL FIRES

John R. Hall, Jr.

March 2009



National Fire Protection Association  
Fire Analysis and Research Division

## **HOME ELECTRICAL FIRES**

**Part I. Home Structure Fires Involving  
Electrical Failure or Malfunction**

**Part II. Home Structure Fires Involving  
Electrical Distribution or Lighting Equipment**

**John R. Hall, Jr.**

**March 2009**



**National Fire Protection Association  
Fire Analysis and Research Division**

## **Abstract**

### *Home electrical fires*

In 2006, an estimated 52,500 home structure fires reported to U.S. fire departments involved some type of electrical failure or malfunction as a factor contributing to ignition. These fires resulted in 340 civilian deaths, 1,400 civilian injuries, and \$1,447 million in direct property damage.

### *Home electrical distribution or lighting equipment fires*

In 2006, an estimated 25,100 reported U.S. non-confined home structure fires involving electrical distribution or lighting equipment resulted in 370 civilian deaths, 840 civilian injuries, and \$776 million in direct property damage.

These estimates are based on data from the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual fire department experience survey.

Keywords: Electrical fire, wiring, lamp, light, cord, plug, fuse, circuit breaker, transformer, outlet, receptacle, switch, generator, battery, fire statistics, home fires, residential fires.

## **Acknowledgements**

The National Fire Protection Association thanks all the fire departments and state fire authorities who participate in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. These firefighters are the original sources of the detailed data that make this analysis possible. Their contributions allow us to estimate the size of the fire problem.

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

For more information about the National Fire Protection Association, visit [www.nfpa.org](http://www.nfpa.org) or call 617-770-3000. To learn more about the One-Stop Data Shop go to [www.nfpa.org/osds](http://www.nfpa.org/osds) or call 617-984-7443.

Copies of this analysis are available from:

National Fire Protection Association  
One-Stop Data Shop  
1 Batterymarch Park  
Quincy, MA 02169-7471  
[www.nfpa.org](http://www.nfpa.org)  
e-mail: [osds@nfpa.org](mailto:osds@nfpa.org)  
phone: 617-984-7450

NFPA No. USS37

Copyright © 2009, National Fire Protection Association, Quincy, MA

## Executive Summary

### *Home electrical fires*

The most inclusive and direct interpretation of “electrical fire” is a fire involving some type of electrical failure or malfunction. In 2006, an estimated 52,500 home structure fires reported to U.S. fire departments involved some type of electrical failure or malfunction as a factor contributing to ignition. These fires resulted in 340 civilian deaths, 1,400 civilian injuries, and \$1,447 million in direct property damage. These 2006 home electrical fires represented 13% of total 2006 home structure fires, 13% of associated civilian deaths, 11% of associated civilian injuries, and 21% of associated direct property damage.

These statistics include fires reported as “confined fires,” for which detailed reporting is not required. Estimates of detailed characteristics for confined fires require statistical allocation of a large share of unknowns and so involve less confidence. In this analysis, fires reported as confined fires added an average of 15% to the non-confined fire estimates in 2003-2006. They added less than 1% to civilian deaths and injuries and to direct property damage. Most of the confined fires (61%) were fires confined to a cooking vessel, and most of the rest (27% of the total) were fires confined to fuel burner, boiler, chimney or flue. The rest were fires confined to trash (6%), fires confined to a commercial compactor (3%), and fires confined to an incinerator (3%).

Roughly half (46%) of 2003-2006 reported non-confined U.S. home structure fires involving electrical failure or malfunction had some type of electrical distribution or lighting equipment as equipment involved in ignition. The leading other types of equipment involved in ignition were fan (6%), clothes dryer (5%), air conditioning equipment (4%), space heater (3%), water heater (3%), and range (3%).

### *Home electrical distribution or lighting equipment fires*

In 2006, an estimated 25,100 reported U.S. non-confined home structure fires involving electrical distribution or lighting equipment resulted in 370 civilian deaths, 840 civilian injuries, and \$776 million in direct property damage. Fires reported as confined fires would add only 1.8% to the estimated non-confined fires and less than 0.2% to associated losses. Therefore, they are not included in the rest of the analysis.

As with other types of equipment cited as equipment involved in ignition, all that we know from this designation is that the equipment provided the heat leading to ignition. That does not mean that there was electrical or any other type of failure or malfunction. For example, a hot light bulb might have been too close to combustibles.

Electrical distribution or lighting equipment accounted for 5% of 2003-2006 home structure fires, ranking third among major causes behind cooking equipment and heating equipment. Electrical distribution or lighting equipment also accounted for 12% of associated civilian deaths (ranking behind smoking materials, heating equipment, and cooking equipment), 6% of

associated civilian injuries (ranking sixth), and 12% of associated direct property damage (ranking third).

The report is organized around three major sub-groups of electrical distribution or lighting equipment:

- Premises wiring group, which includes all equipment defined as “premises wiring” in electrical codes *except* light fixtures. Generators, batteries, rectifiers, chargers, and inverters are also included in this group for analysis purposes. “Premises wiring” includes these types of equipment:
  - Wiring
  - Outlets, receptacles, and switches
  - Transformers and overcurrent protection equipment
  - Meters and meter boxes
- Lamps, light fixtures, light bulbs, and signs
- Cords and plugs

There are also two minor equipment groups:

- Electric fences
- Lightning rods and lightning arresters

The national estimates in this report are derived from data reported to the U.S. Fire Administration’s National Fire Incident Reporting System (NFIRS). Fires declined by about one-third from 1980 to 1998. Version 5.0 of NFIRS, introduced in 1999, contained numerous changes in data categories, definitions, and rules. After the transition period of 1999-2001, when NFIRS Version 5.0 was being phased in, the estimates settled into a level about one-half lower than the levels of the late 1990s, a much larger decline than would have been expected if the 1980-1998 trend had continued unchanged. Associated losses also showed large declines coinciding with the shift to NFIRS Version 5.0.

The premises wiring group<sup>\*</sup> accounted for the largest share (61%) of 2003-2006 home structure fires involving electrical distribution or lighting equipment, followed by lamps, light fixtures, and light bulbs (26%) and cords and plugs (12%).

Three-fourths (74%) of 2003-2006 non-confined home structure fires involving electrical distribution or lighting equipment cited some type of electrical failure or malfunction as a factor contributing to ignition.

The majority of 2003-2006 non-confined home structure fires involving electrical distribution or lighting equipment began with ignition of products and materials often found in structural areas, including wire or cable insulation (31%), structural member or framing (13%), insulation within structural area (5%), exterior wall covering (5%), or interior wall covering (5%).

Two-fifths (40%) of deaths in 2003-2006 non-confined home structure fires involving electrical distribution or lighting equipment resulted from fires that began in a living room, family room, or den.

---

\* “Premises wiring” refers to all installed wiring equipment between power source and outlet. For purposes of analysis, the “premises wiring group” is defined to exclude light fixtures and to include power sources, including generators, batteries, rectifiers, inverters, and chargers.

Three-fourths (72%) of deaths in 2003-2006 home structure fires involving electrical distribution or lighting equipment involved victims who were outside the area of origin when fire began. By comparison 58% of fatal victims for all home structure fires were outside the area of origin.

Home structure fires involving electrical distribution or lighting equipment, in 2003-2006, show a winter peak similar to that for heating equipment but less pronounced.

In 2007, 43 people died of injuries from unvented carbon monoxide from generators. Fueled equipment to generate electricity is the only type of electrical distribution or lighting equipment that can produce carbon monoxide.

The death toll from carbon monoxide produced by generators has increased sharply in recent years until 2007, from less than 10 per year on average in 1999 and prior years to 19 per year in 2000-2001, 47 per year in 2002-2004, 89 per year in 2005-2006, and back to 43 in 2007.

### **Safety Tips**

- Home electrical safety begins with NFPA 70, *National Electrical Code*®, and related documents with special relevance to homes, notably NFPA 73, *Electrical Inspection Code for Existing Dwellings*. However, work on home electrical distribution or lighting equipment should only be conducted by someone qualified as an electrician. When you are buying, selling or remodeling a home, have it inspected by a professional electrician.
- Call a qualified electrician or landlord if you have
  - recurring problems with blowing fuses or tripping circuit breakers,
  - a tingling feeling when you touch an electrical appliance,
  - discolored or warm wall outlets,
  - a burning smell or rubbery odor coming from an appliance,
  - flickering lights,
  - sparks from an outlet.
- Arc fault circuit interrupters (AFCIs) are a type of circuit breaker that shuts off electricity when a dangerous condition occurs. Consider having them installed in your home. Use a qualified electrician.



## Table of Contents

	<b>Page</b>
Abstract	
Executive Summary	i
Table of Contents	v
List of Tables and Figures	vii
Fact Sheet	ix
Introduction	1
Part I. Home Structure Fires Involving Electrical Failure or Malfunction	3
Electrical Fires	5
Part II. Home Structure Fires Involving Electrical Distribution or Lighting Equipment	17
Electrical Distribution or Lighting Equipment	19
Premises Wiring Group	39
Lamps, Light Fixtures, and Light Bulbs	67
Cords and Plugs	91
Appendix A: How National Estimates Statistics are Calculated	105
Appendix B: What Is an Electrical Fire?	109



## List of Table and Figures

	<b>Page</b>
<i>Part I. Home Structure Fires Involving Electrical Failure or Malfunction</i>	
Figure 1. Home Structure Fires Involving Electrical Failure or Malfunction by Year	5
Table A. Home Fires Involving Electrical Failure or Malfunction as Factor Contributing to Ignition, by Factor Contributing to Ignition	6
Table B. Risk Ratios for Rates of Electrical Distribution or Lighting Equipment per Million Dwellings, by Age of Dwelling	9
Table 1. Home Structure Fires Involving Electrical Failure or Malfunction as Factor Contributing to Ignition, by Year	13
Table 2. Home Structure Fires Involving Electrical Failure or Malfunction, by Equipment Involved in Ignition	14
<i>Part II. Home Structure Fires Involving Electrical Distribution or Lighting Equipment</i>	
Figure 2. Home Structure Fires Involving Electrical Distribution or Lighting Equipment, by Year	19
Table C. Home Fires Involving Electrical Distribution or Lighting Equipment, by Major Equipment Group	20
Figure 3. Non-Confined Home Structure Fires and Deaths Involving Electrical Distribution or Lighting Equipment, by Time of Day	22
Figure 4. Non-Confined Home Structure Fires and Deaths Involving	22
Table D. Electrocution Deaths Involving Electrical Distribution or Lighting Equipment	24
Table E. Injuries Involving Electrical Distribution or Lighting Equipment Reported to Hospital Emergency Rooms	25
Table 3. Home Fires Involving Electrical Distribution or Lighting Equipment, by Year	27
Table 4. Home Fires Involving Electrical Distribution or Lighting Equipment, by Factor Contributing to Ignition	28
Table 5. Home Fires Involving Electrical Distribution or Lighting Equipment, by Human Factor Contributing to Ignition	29
Table 6. Home Fires Involving Electrical Distribution or Lighting Equipment, by Item First Ignited	30

## List of Table and Figures (Continued)

	<b>Page</b>
Table 7. Home Fires Involving Electrical Distribution or Lighting Equipment, by Area of Origin	31
Table 8. Civilian Deaths and Injuries in Home Fires Involving Electrical Distribution or Lighting Equipment, by Victim Location at Ignition	32
Table 9. Civilian Deaths and Injuries in Home Fires Involving Electrical Distribution or Lighting Equipment, by Victim Activity When Injured	33
Table 10. Home Fires Involving Electrical Distribution or Lighting Equipment, by Time of Day	34
Table 11. Home Fires Involving Electrical Distribution or Lighting Equipment, by Month	35
Table 12. Fires in Other Countries Related to Home Electrical Distribution or Lighting Equipment	36



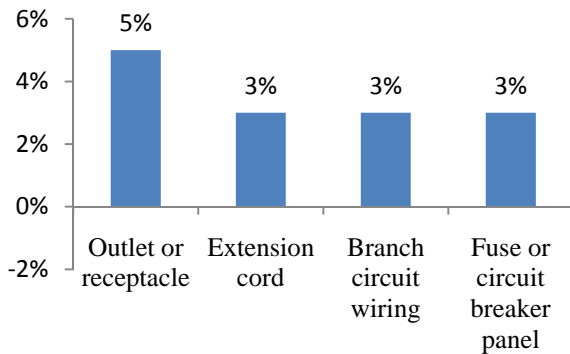
## Home Fires Involving Electrical Failure or Malfunction

U.S. fire departments responded to an estimated average of 52,500 reported U.S. home<sup>1</sup> structure fires involving electrical failure or malfunction in 2006. These fires resulted in 340 civilian deaths, 1,400 civilian injuries and \$1,447 million in direct property damage.

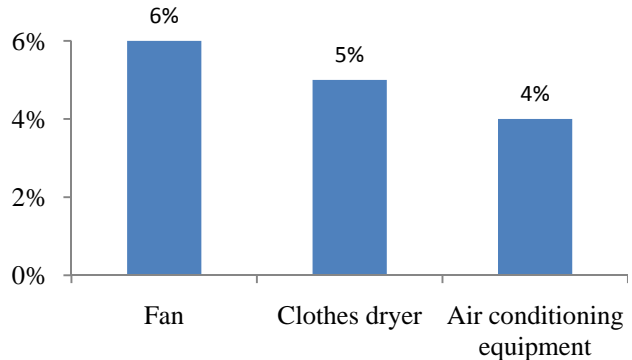
46% of home electrical failure fires involved electrical distribution or lighting equipment in 2003-2006.

47% of electrical failure home fires involved other known types of equipment in 2003-2006.

**Leading Known Types of Electrical Distribution or Lighting Equipment Involved in Home Electrical Failure Fires, 2003-2006**



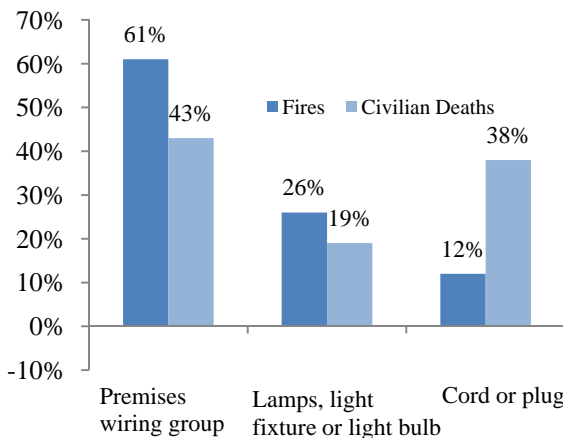
**Leading Other Known Types of Equipment Involved in Home Electrical Failure Fires, 2003-2006**



## Home Fires Involving Electrical Distribution or Lighting Equipment

U.S. fire departments responded to an estimated average of 25,100 reported U.S. non-confined home structure fires involving electrical distribution or lighting equipment in 2006. These fires resulted in 370 civilian fire deaths, 840 civilian fire injuries, and \$776 million in direct property damage.

**Home Fires Involving Electrical Distribution or Lighting Equipment, by Major Equipment Group 2003-2006**



### In 2003-2006:

Some type of electrical failure or malfunction was cited as factor contributing to ignition for 74% of electrical distribution or lighting equipment home structure fires.

Two-fifths (40%) of civilian deaths in home structure fires involving electrical distribution or lighting equipment began in the living room, family room or den.

Wire or cable insulation is what ignited first in 31% of electrical distribution or lighting equipment home structure fires.

<sup>1</sup>Homes are dwellings, duplexes, manufactured homes, apartments, townhouses, and rowhouses.

