

## **ROLE OF SMOKE ALARMS IN FIRE DISASTER PREVENTION MANAGEMENT FOR HOMES**

*Robert M. Brooks*

*Associate Professor, Department of Civil & Environmental Engineering, Temple University,  
Philadelphia, USA*

### **ABSTRACT**

*Smoke alarms play an important role in a fire disaster prevention management program. The objective of this paper is to determine the role of a smoke alarm in the fire disaster management program for homes. 21 volunteers are asked to participate in the survey. They visited 42 homes. From their experience and subjective opinion, the following results are obtained.*

*The fatalities are reduced from 100 to 52 when at least one working smoke alarm is present in the home. This is a statistically significant influence. The above conclusion is supported by the following statistical indicators. The p-score, one-tailed t value, and standard deviation are 0.0%, 57.89 and 5.71 respectively.*

**KEYWORDS:** *Smoke Alarm, Fire Disaster, Prevention Management*

---

### **Article History**

**Received: 20 Mar 2018 / Revised: 23 Mar 2018 / Accepted: 26 Mar 2018**

---

### **INTRODUCTION**

As per the American Red Cross fact sheet<sup>1</sup>, nationally, the number of home fires is on the rise in the number of fires increasing 8 percent since 2000. Only 26 percent of families have actually developed and practiced a working Home Fire Escape Plan<sup>1</sup>.

Because of the above statistics, a fire disaster prevention management becomes essential in reducing the bad effects. In this management program reducing the number of fatalities due to fires plays an important role. The objective of this paper is to predict the role of smoke alarms in fire disaster prevention management for homes.

### **COMMON FIRE HAZARDS**

As per reference 2, examples of some of common fire hazards are the following: Deteriorated batteries, cooking appliances, electronic and electrical equipment, unattended cooking, personal ignition sources such as matches, lighters, unprotected combustible storage areas, household appliances, smoking, deteriorated electrical wiring, flammable materials, candles and other open flames, heating appliances, poorly maintained fireplace chimneys, heat generating equipment, equipment that utilizes combustible materials, and overloaded electrical systems<sup>2</sup>. In real life, the list is not limited to the above. Because of space constraints, Electrical Fires and candle safety issues only are elaborated as shown below. These are only examples and not a complete list.

## **ELECTRICAL FIRES<sup>3</sup>**

As per the city of Vancouver<sup>3</sup>, the following is the information regarding Preventing Electrical fires<sup>3</sup>.

### **Preventing Electrical Fires<sup>3</sup>**

Electrical fires are known to be one of the leading house fire causes. This section will explain a relative overview of electrical cord, plug, and appliance safety. One must use the services of a certified electrician in all respects on the subject matter<sup>3</sup>.

### **Electrical Cord and Electrical Plug Safety<sup>3</sup>**

To minimize the risk of electrical fires, owners and users should survey electrical cables and plugs regularly. Also, this risk can be reduced through the use of three-hole pronged outlets in comparison to two-pronged outlets, not dismantling three-hole prong off into a two-pronged outlet, and disposing of all cords or plugs that show signs of disintegration<sup>3</sup>.

### **When Plugging in or Unplugging Items<sup>3</sup>**

To prevent these fires (1) unused outlets must be covered with safety plugs or spring-latch covers should be installed in the presence of young children, (2) running electrical cords underneath carpets must be refrained, (3) do not use multi-outlet extenders, power bars, and surge protectors in an overbearing manner (to avoid overloading a single circuit), (4) hold a plug securely when removing from a wall (to avoid wearing the cord out or shorting a circuit, electrical shock, or spontaneous fire), (5) separate electrical cords from sources of heat and water, and (6) certified electrician service must be taken to install additional electrical outlets for the use of extension cords<sup>3</sup>.

### **Electrical Appliance Safety<sup>3</sup>**

To ensure appliance safety: defective appliances must be inspected by a professional; proceed correctly with manufacturer instructions and guides: unplug small appliances not being used; unplug small appliances before properly cleaning them; and only purchase national standard association approved appliances<sup>3</sup>.

### **Check for Inadequate Electrical Wiring<sup>3</sup>**

Inadequate wiring tends to be found in older homes and apartments, which pose electrical and fire hazard. When one's home has any of the following issues a certified electrician must inspect its electrical system: (1) upon noticing dimming of certain appliances, (2) Running multiple extension cords or plug multiple cords into an individual outlet due to lack of outlets, (3) when small appliances are slow to heating, (4) entering rooms in darkness resulting from lack of three or four-way light switches, (5) limited furniture arrangement options for closer electrical outlets range. An appliance must be unplugged before another is plugged in to avoid circuit breaking or fuse blowing<sup>3</sup>.

## **CANDLE SAFETY<sup>4</sup>**

As per the Philadelphia Fire department<sup>4</sup>, the following are some of the notes regarding candle safety. These are only examples, but not the complete list. All candles must be extinguished when leaving the room or going to sleep. Candles must be kept away from all the fire catching material. Candle holders must not be prone to tip over easily and they must be made with fire resistant material. Windows must be free from light candles. Candle holders must be extinguished before the last half-inch of wax starts to melt. Candles with combustible items embedded in them must not be used.

## **Candles and Children**

Candles, lighters, and matches must be kept out of reach of children. A child must not be left alone in a room with a candle and must not be allowed to have candles in their bedrooms.

## **Candle Safety during Power Outages**

Candles must not be used when searching for items in a confined space. Never use a candle for a light before flammable materials.

## **METHODOLOGY**

The Propensity of the home fires and intensity of damage (in lives and dollars) is predicted based on the field visits in Philadelphia, Pattern Identification, Research, survey data, and weight, age factors (depending on the importance of the variable) assigned to the variables as shown below:

If the home has at least one working 10 years LED battery Fire Alarm, then the surveyor should assign a weighting factor of 10 for the fatalities. On the other hand, if the home does not have any working Fire Alarm, then the factor should be 4. 21 volunteers are asked to participate in the survey during the years of 2016 and 2017. They visited 42 homes. From their experience and subjective opinion the following results are obtained.

## **RESULTS AND DISCUSSIONS**

The fatalities are reduced relatively from 100% to 52% when at least one working smoke alarm is present in the home. This is a statistically significant influence. The above conclusion is supported by the following statistical indicators. The p-score, one-tailed t value, and standard deviation are 0.0%, 57.89 and 5.71 respectively<sup>5,6,7</sup>.

The results are based on the opinion the survey participants.

The results are based on the opinion the survey participants. The results are comparable with those of national standards (NIST)<sup>8</sup> as described below. U.S. fire statistics for home structure fires from Years 2000-2004 reveal that 34% of civilian deaths occurred in homes with operating smoke alarms, 22% of civilian deaths occurred in homes with smoke alarms present, but that failed to operate, and 43% of civilian deaths occurred in homes with no smoke alarms (Reference NIST). Thus, if a home does not have a working smoke alarm the civilian death rate increases by 94% (from 34% to 66%). Thus the fatalities are reduced from 100 to 49% when smoke alarms are present in the home.

## **CONCLUSIONS**

Working smoke alarms play an important role in fire disaster prevention management program. One of the most important objectives of this management program is to reduce fatalities caused due to home fires.

The conclusion of this study is that the fatalities are reduced from 100% to 52% when at least one working smoke alarm is present in the home.

## **Scope and Disclaimer of this Paper**

The scope of this paper is strictly limited to gaining knowledge only. The author and the journal disclaim all other responsibilities. Do not use this paper for any other purpose except as an educational tool. Consult an appropriate licensed professional for any practical purposes.

## ACKNOWLEDGEMENTS

The author acknowledges the help of Southeastern Pennsylvania Chapter of the American Red Cross, Philadelphia.

## REFERENCES

1. [http://www.redcross.org/images/MEDIA\\_CustomProductCatalog/m4440088\\_FireSafetyFactSheet.pdf](http://www.redcross.org/images/MEDIA_CustomProductCatalog/m4440088_FireSafetyFactSheet.pdf)
2. [https://en.wikipedia.org/wiki/Fire\\_safety#cite\\_note-1](https://en.wikipedia.org/wiki/Fire_safety#cite_note-1)
3. <http://vancouver.ca/home-property-development/preventing-electrical-fires.aspx>
4. [http://www.phila.gov/fire/pdfs/candle\\_safety.pdf](http://www.phila.gov/fire/pdfs/candle_safety.pdf)
5. Haldar, A and Mahadevan, S. 2000. "Probability, Reliability and statistical Methods in Engineering Design", John Wiley and sons, New York.
6. Kuebler R. and Smith, 1976. "Statistics", John Wiley and sons, Inc. New York
7. Lipsey, M.W. 1990. "Design Sensitivity: Statistical power for experimental research". Newbury Park, CA, Sage.
8. <https://www.nist.gov/>