



Smoke Alarms Guidance Document

Provided to its members by the National Association of State Fire Marshals

Summary

The National Association of State Fire Marshals (NASFM) believes that a home with both ionization and photoelectric alarms or combination/dual sensor alarms will ensure the fastest response to both flaming and smoldering fires. Smoke alarms should be installed on every level of the home, outside sleeping areas and inside bedrooms. Some states and local jurisdictions have specific requirements about types of smoke alarms that should be used and where they should be installed in the home.

With this guidance document, NASFM provides a summary of current information about the research on residential smoke alarms, explains the different response characteristics of the sensing mechanisms in different types of alarms and offers advice regarding what to tell the public about smoke alarm use.¹ It is important to note that smoke alarms are only one component of a comprehensive residential fire protection plan.

Background

Early detection of fires is crucial to escape time, because the time to untenable conditions in residences can be as little as 3 minutes for flaming fires. Current smoke alarms based upon ionization and/or photoelectric technologies, properly placed in a residence, quickly alert occupants in most fires. In controlled experiments, the most common form of sensing device, the ionization sensor, reacts more quickly to flaming fires, such as those involving paper or flammable liquids. A photoelectric sensor reacts more quickly to smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses.

A comprehensive study on residential smoke alarm technology was completed in 2004 by the National Institute of Standards and Technology (NIST), along with Underwriters Laboratories, the US Fire Administration, the US Consumer Product Safety Commission, the US Centers for Disease Control and Prevention, and other sponsors (the final report, revised in 2008, is at <http://smokealarm.nist.gov/>). Additional research has been conducted more recently by NIST^{2,3} to better quantify the response time of photoelectric and ionization sensors to well-controlled and repeatable smoldering and flaming fires on foam furniture, and the impact on available safe egress time in a residential structure.

A home that has both ionization and photoelectric alarms or combination/dual sensor alarms will ensure the fastest response to both flaming and smoldering fires. Ionization alarms cost between \$5-\$15 retail,

¹ NASFM is grateful to its Science Advisory Committee for review and suggestions to this document.

² <http://fire.nist.gov/bfrlpubs/fire09/PDF/f09006.pdf>

³ <http://fire.nist.gov/bfrlpubs/fire09/PDF/f09007.pdf>

photoelectric alarms cost between \$15-\$20 and combination/dual sensor alarms cost between \$20-\$40, depending on features.

It is most important to maintain working smoke alarms, regardless of the sensing technology, as long as the smoke alarm has been approved by a recognized certifying body. Smoke alarms must be tested, cleaned and replaced according to manufacturers' instructions, and otherwise they should never be disabled.

Information for Public Dissemination

The National Association of State Fire Marshals (NASFM) and its Science Advisory Committee suggest that State Fire Marshals include the following information when they educate the public about the use of smoke alarms.

Why Install Smoke Alarms?

- Smoke alarms save lives, prevent injuries, and minimize property damage by detecting and alerting residents to fires early in their development. The risk of dying from fires in homes without smoke alarms is twice as high as in homes that have working smoke alarms.

Types of Alarms

- There are two main types of sensing technologies used in smoke alarms. Ionization sensors respond quickly to flaming fires, such as those involving paper or flammable liquids. Photoelectric sensors respond quickly to smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses. These two sensing technologies can be used singly (such as in an ionization smoke alarm, or in a photoelectric smoke alarm) or in combination (referred to as a dual sensor ionization/photoelectric smoke alarm). Recent studies have shown that in most cases, properly designed and maintained dual ionization/photoelectric smoke alarms can provide a quick response to the broadest range of smoldering and flaming fires. Independent of the sensing technology, only smoke alarms that have the approval of a recognized certifying body should be installed.
- Smoke alarms can be battery operated or hard-wired to the home's electrical system with a battery backup.

Installation and Maintenance

- As recommended by NFPA 72[®], the National Fire Alarm and Signaling Code, 2010 Edition, working smoke alarms should be installed on every level of the home, outside sleeping areas and inside bedrooms. The sensing technology selected by the homeowner for installation is less important than the number and placement of the smoke alarms.
- Interconnection of smoke alarms is a requirement for new homes and those that need to meet current codes. Interconnected smoke alarms provide additional assurance that occupants will be alerted and respond quickly to a fire. Smoke alarms can be interconnected using hard-wiring. Listed, battery-powered alarms with wireless interconnect capability also are available as a cost-effective retrofit option where allowed by the local jurisdiction.

- Locate smoke alarms away from air vents or registers, and avoid other spaces with high airflow. Vacuum around the alarm unit to keep it free from dust and insects. Current manufacturers' guidance is to test alarms weekly and clean them monthly to make sure they operate properly. If the unit is battery operated or has battery back-up, the batteries should be replaced at least once a year, and whenever the alarm gives a low battery signal. The smoke alarm unit itself should be replaced every 10 years.
- Never remove the batteries to disable a smoke alarm, even if you experience "nuisance" alarms, such as while cooking or showering. Fan the detector with a newspaper or towel to stop the alarm. Locate alarms away from the kitchen or bathroom to avoid common causes of nuisance alarms. If the smoke alarm is within 20 feet of a cooking appliance, consider an alarm with silencing feature (hush button) to suppress nuisance alarms, or one that uses a photoelectric sensor, which is less susceptible to cooking nuisance alarms.
- Some states require that particular types of smoke alarms be installed in certain areas of the home. Check your state and local laws or consult with your State Fire Marshal and local fire officials to find out if your state or locality has specific requirements.

Alternate Alarm Technologies for Children, the Elderly and the Hard of Hearing

- Some children may not awaken from the sound of a smoke alarm. Parents should hold a fire drill during the night so they can assess their children's ability to awaken and respond appropriately. Certain types of alarms project a recording of a parent's voice or some other sound to which children may be more responsive than the traditional alarm.
- For households with individuals who are deep sleepers or who have mild to severe hearing loss, as frequently is the case for the elderly, a smoke alarm with a low-frequency alarm signal that complies with NFPA 72 requirements should be considered. For households with individuals who have severe hearing loss (i.e., deaf), visible strobes are necessary. Bed-shakers that produce a vibratory stimulus to wake sleeping occupants should also be considered.
- While such alternative technologies are more expensive than typical smoke alarm technologies, exploring approaches such as these may make sense in households where the typical alarms are not effective for all the residents.

Home Escape Planning Is Essential

- Develop and regularly rehearse an escape plan with all members of your household, so that when the smoke alarm sounds, everyone will move to a safe location outside the home. If children or other family members do not awaken to or hear the smoke alarm, the home escape plan should be adjusted accordingly to help get all family members out safely. For information on home fire escape plans, see http://www.usfa.dhs.gov/citizens/all_citizens/home_fire_prev/escape/ and <http://www.nfpa.org/categoryList.asp?categoryID=393&URL=Research%20&%20Reports/Fact%20sheets/Escape%20planning>.

For additional information on smoke alarms, contact your State Fire Marshal's office.

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