



Ionization and Photoelectric Smoke Alarms

With this guidance document, the National Association of State Fire Marshals (NASFM) hopes to convey to State Fire Marshals a summary of current information about the research on ionization and photoelectric residential smoke alarms. It aims to explain the different response characteristics of these two types of alarms and offer advice for 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.

A comprehensive study on residential smoke alarm technology was recently completed by the National Institute of Standards and Technology, 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. This work evaluated current and emerging smoke alarm technology responses to common residential fire scenarios and nuisance alarm sources (the link to published work on the NIST website is <http://smokealarm.nist.gov/>). While additional research continues, the following information can be verified at this time.

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 typical flaming fire scenarios. Both ionization and photoelectric smoke alarm technologies quickly alert occupants in most fire scenarios. In controlled experiments, ionization alarms react earlier than photoelectric alarms in fast-flaming fires, such as those involving paper or flammable liquids, while photoelectric alarms tend to react substantially earlier than ionization alarms in smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses.

Experts recommend that a home have both ionization and photoelectric alarms or dual alarms to ensure the fastest response to both flaming and smoldering fires. Ionization alarms cost about \$5 retail, photoelectric alarms cost about \$20 and dual alarms cost about \$30.

It is most important to get working smoke alarms in 100% of residences. They should never be disabled. Smoke alarms must be tested, cleaned and replaced according to manufacturers' instructions.

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:

- 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

¹ NASFM is grateful to its Science Advisory Committee, Consumer Product Safety Task Force and Public Education Committee for their contributions to this document.

from fires in homes without smoke alarms is twice as high as in homes that have working smoke alarms.

- There are two main types of smoke alarms, and both detect all types of growing fires. Ionization alarms, which sell for about \$5 for battery-operated models, respond faster to flaming fires, such as those involving paper or flammable liquids. Photoelectric alarms, which sell for about \$20, respond faster to smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses. Dual ionization/photoelectric alarms are also available, and cost about \$30.
- To ensure that both smoldering and flaming fires are detected as quickly as possible, the best protection is to have both types of alarms installed, or dual ionization/photoelectric alarms.
- Working smoke alarms should be installed on every level of the home, outside sleeping areas and inside bedrooms, per manufacturer's specifications. Locate smoke alarms away from air vents or registers, and avoid other spaces with high airflow.
- All smoke alarms must be kept free of 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. In addition, experts say that 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. Clean the smoke alarm according to the manufacturer's instructions, and if possible relocate it away from the kitchen or bathroom. Some smoke alarms have a silencing feature, so nuisance alarms can be stopped quickly and easily.
- Evidence indicates that 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. If children, or any 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. NASFM is aware of certain types of alarms that project a recording of the parents' voice or some other sound to which children may be more responsive than the traditional alarm.
- For elderly people, those who have impaired hearing or those who have other disabilities that make the alarm difficult to hear, there are smoke alarms that use strobe lights and vibrators in addition to sound. Exploring alternative approaches such as these may make sense in those households.
- 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. For information on how to develop a home escape plan, see <http://www.nfpa.org/assets/files/PDF/FPWgrid03.pdf>.

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