Understanding Smoke Alarms

Allied Construction Industries

October 15, 2013
My Family
Allie
Sisters
Our Girls as Young Women
The OSU Fire - We lose Andrea

April 13, 2003
The Aftermath
Information Fire Officials Provide to the Public
(NFPA, NIST, USFA)

Everyone needs a smoke alarm.

Maintain your smoke alarm.

Ionization alarms are faster at detecting flaming fires. Photoelectric alarms are faster at detecting smoldering fires.
Understanding Smoke Alarms: How Each Technology Is Designed To Work

Ionization

Photoelectric
Percent of unwanted activations in 8 test houses for 234 cooking events over 30 days.

Percentages: Dual 7.9%, Ionization 6.25%, Photoelectric 1.6%
“False Alarms and Unwanted Activations”
From:
U.S. EXPERIENCE WITH SMOKE ALARMS
AND OTHER FIRE DETECTIONAL/ALARM EQUIPMENT
By: Marty Ahrens
Fire Analysis and Research Division
National Fire Protection Association

Ionization devices had a disproportionate share of nuisance alarms. Cooking smoke tends to contain more of the smaller particles (less than one micron) that activate an ionization-type device rather than the larger particles that activate a photoelectric-type device. In the National Smoke Detector Project, **97% of the devices tested for involvement in nuisance alarms were ionization-type devices.**

Most people do not automatically assume a sounding smoke alarm is an emergency situation. In some cases, they know what caused the alarm and know that they are safe. However, lives have been lost when real alarms were mistakenly considered false. **Unwanted activations can generate a dangerous sense of complacency.**

November 2004
## ASET

Available time you have to escape a fire (in seconds)

<table>
<thead>
<tr>
<th></th>
<th>PHOTOELECTRIC</th>
<th>IONIZATION</th>
<th>DUAL ION/PHOTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLAMING</td>
<td>FLAMING</td>
<td>FLAMING</td>
<td></td>
</tr>
<tr>
<td>Living Room</td>
<td>108</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td>Living Room (Rep)</td>
<td>134</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Living Room (FF)</td>
<td>144</td>
<td>172</td>
<td></td>
</tr>
<tr>
<td>Bedroom</td>
<td>350</td>
<td>374</td>
<td></td>
</tr>
<tr>
<td>Bedroom (Closed)</td>
<td>3416</td>
<td>3438</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SMOLDERING</th>
<th>SMOLDERING</th>
<th>SMOLDERING</th>
<th>SMOLDERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Living Room</td>
<td>3298 (55 min.)</td>
<td>16</td>
<td>3332</td>
</tr>
<tr>
<td>*Living Room (AC)</td>
<td>2773 (46 min.)</td>
<td>(-54)</td>
<td>2108</td>
</tr>
</tbody>
</table>

NIST Technical Note 1455-1 (page 243 and is two story, alarm on each level, ASET in seconds) February 2008 Revision. Performance of Home Smoke Alarms Analysis of the Response of Several Available Technologies in Residential Fire Settings
The photoelectric is blue  The ionization is red
In summary, the research conducted by NIST staff leads to the conclusion that both ionization and photoelectric alarms provide enough time to save lives for most of the population under many fire scenarios; however, ionization alarms may not always alarm even when a room is filled with smoke from a smoldering fire, exposing the most sensitive populations with mobility limitations to an undetermined risk. Photoelectric detectors can provide a lot more warning time than ionization detectors in a smoldering fire; at the same time a smoldering fire can take a longer period to become dangerous. Ionization detectors can provide a little more time than photoelectric detectors in a flaming fire; in this case there can be little time to spare. Changes in furnishing materials and construction over the past decades have reduced the time available for safe egress in any fire. NIST is currently conducting research to assess whether or not modifications may be needed in the standard test method for certifying residential smoke alarms to accommodate the changing threat.
Risk Analysis of Residential Fire Detector Performance

Larry Grosse Ph.D., Texas A&M University, Jac DeJong Ph.D. Texas A&M University, and John Murphy Ph.D., Colorado State University

![Bar Chart]

- **Alarm Type**
  - Ionization
  - Photoelectric

- **Smoldering**
  - Failures:
    - Ionization: Low
    - Photoelectric: Low

- **Flaming**
  - Failures:
    - Ionization: Moderate
    - Photoelectric: Low
Residential Fire Deaths with a Smoke Alarm Present

Non-Working Alarm
- Dead Battery
  - Removed Battery
    - Removed due to Nuisance alarm problems

Working Alarm
- Victim Intimate with fire
- Behavioral /Physical Factors
- Technology Failure
  - Alarm didn’t operate or signaled too late

37.29% 62.7%
Baltimore & Boston
Fire Fatalities From 2009-2012

Baltimore: 75

Boston
Fire Fatalities From 2009-2012

Baltimore: 75
Boston: 4