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Deadly Differences:
Ionization vs Photoelectric Smoke Alarms

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ICC PREFERRED EDUCATION PROVIDER

Course: 9649

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Deadly Differences
Ionization vs Photoelectric Smoke Alarms

Disclaimer:
The Opinions Expressed Are Those of the Presenter.

This presentation is intended for informational purposes ***only***
and is not intended to expand to scope of a general property inspection or the ASHI Standard of Practice.

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An In-Depth Look at US Fire Death Rate Statistics and the Performance of Photoelectric and Ionization Smoke Alarms in Residential Fatal Fires

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Skip Walker:

ACI, ASHI Certified Inspector

MCI, CREIA Master Inspector

ICC Certified Residential Combination Inspector

ICC Certified California Residential Building & Plumbing Inspector

F.I.R.E. Service Certified Inspector

Published Numerous Articles on Smoke Alarms, CO Issues and General Inspection Topics

CodeCheck, Co-Author

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What if…….

Your Car Airbags Deployed Every Time You Hit A Pot-Hole?

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But Failed to Deploy in Real Accidents.....

55% *of the Time?*

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"A smoke detector that sounds approximately nineteen minutes after smoke reached its sensing chamber is like an airbag that does not deploy until nineteen minutes after a car accident."

-Judge David E. Schoenthaler, Mercer v. Pitway/BRK Brands (First Alert)

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*There Are Very **REAL** Differences in How Different Smoke Alarms Types Perform in Real World Fatal Fires*

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This is a Very REAL Problem.

This Issue Directly Contributes to at Least 1,000 Fire Deaths Per Year – Probably Many More

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This is an Old Problem.

We Have Known That Ionization Alarms Were Not Providing Adequate Warning Since the Late 1970's.

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As Professional Property Inspectors, We Are Uniquely Positioned to Have a Very Significant Impact on Public Awareness and Safety.

We Can Make a Difference!

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"This issue has more impact on the life safety of your clients than just about anything. Actually, make that just plain anything."

Douglas Hansen, September 2010

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What We Will Talk About Today:

- *US Residential Fire Death and Injury Statistics 1960-2015*
- *Statistical Data, Trends and How to Interpret the Data*
- *A Brief History of Smoke Alarms*
- *The Types of Smoke Alarms Found In Residential Use*
- *Contrast the Performance of the Different Alarm Technologies in Residential Fatal Fires*

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Important: All the Data Used Comes From Reputable Sources
<u>All Data Is Published & Verifiable</u>

NIST	*National Institute for Standards and Testing*
NFPA	*National Fire Protection Association*
CPSC	*Consumer Product Safety Commission*
FEMA	*Federal Emergency Management Agency*
UL	*Underwriters Laboratory*
Texas A&M University	
NFA	*National Fire Administration*
NCHS	*National Center for Health Statistics*
NIFRS	*National Fire Incident Reporting System*

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Now Let's Look At Death/Injury Statistics and Sources:

- **NFPA, Fire Loss Surveys and Various Studies**
  - *Survey of 27,763 Fire Departments Nationally – Many Larger*
- **NFIRS, National Fire Incident Reporting System**
  - Web Input System with Coding For Data Input
  - Voluntary Participation – Currently About 23,000 Fire Departments
  - Participation Varies By State
- **NCHS, US Death Statistics Report**
  - *National Records of Death Certificates*
  - *Cause of Death Classifications Limited*

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None of the Data is Perfect

Estimates Only

- ***There Are No Absolutes***
- ***The Numbers Vary Between Each Source Year to Year***
- ***Sometimes Significantly***

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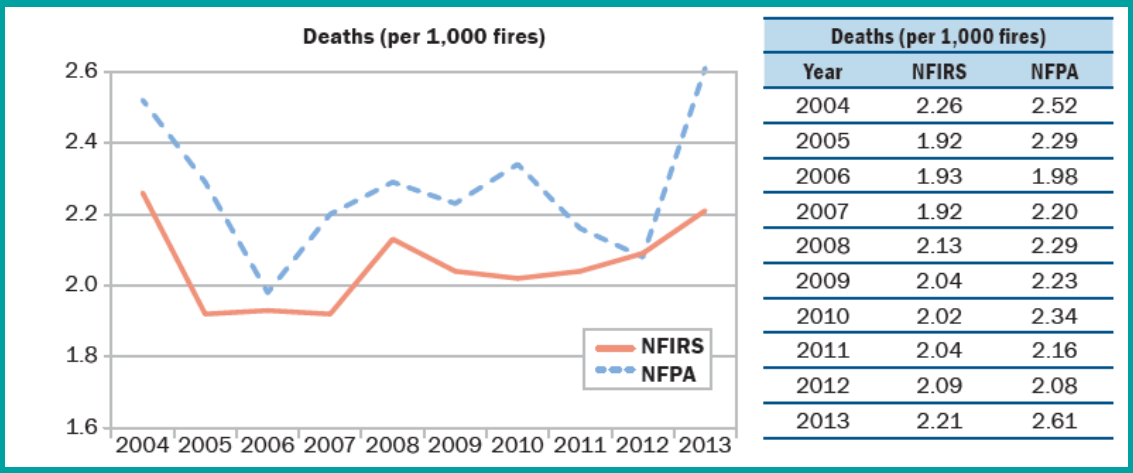

Deaths (per 1,000 fires)		
Year	NFIRS	NFPA
2004	2.26	2.52
2005	1.92	2.29
2006	1.93	1.98
2007	1.92	2.20
2008	2.13	2.29
2009	2.04	2.23
2010	2.02	2.34
2011	2.04	2.16
2012	2.09	2.08
2013	2.21	2.61

NFIRS Versus NFPA Reported US Fire Deaths
Source: Fire in the US, 17th Edition, US Fire Administration

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Studies and Reports:

- ***Fire Report Data: Most NFPA 2015 Fire Loss Report***
  - *Most Current Available*
- ***Some Older Reports Used***
  - *Some Info Not Available in Newer Reports*
- ***Studies: Mix of Older and Newer***
- ***The Technology Hasn't Changed, So Results Are Still Valid***
  - *In General – Some Conditions Changed*
  - *Some Older Reports Used to Demonstrate that There Was Knowledge*
- ***I'm Not Cherry-Picking Reports!***

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- From a Fire Perspective, the US is a Third World Country
- The NYC Fire Department responds to more calls per year than all fire departments in Japan
- US Fire Death Rate per Million Population = 12.3*
- Swiss Fire Death Rate per Million Population = 2.0*
- Singapore Fire Death Rate per Million Population = 2.3*

* ***Source: FEMA International Death Rate Trends 1979-2007***

(This is the most current version of this data)

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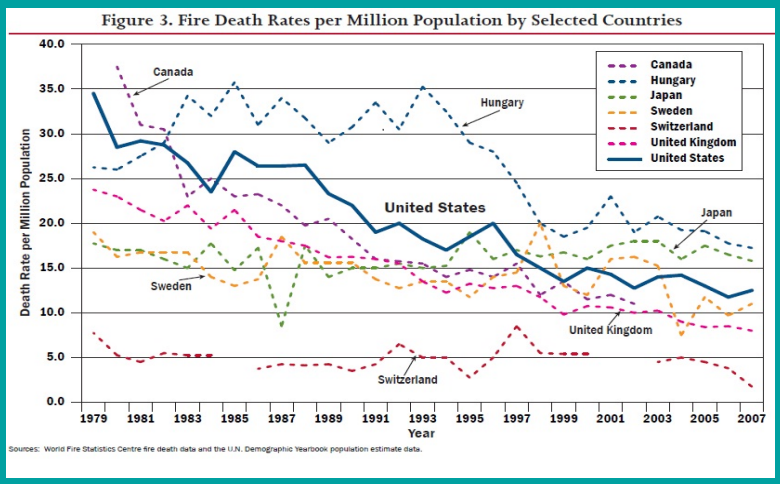

Source: FEMA International Fire Trends 1979-2007

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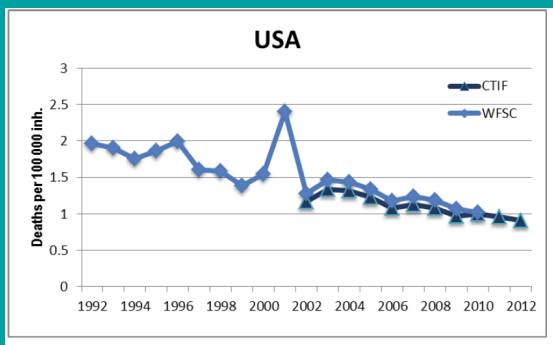

Figure 30 Fire death rate per capita for USA [2, 3, 5, 6, 7, 8] (The peak in 2001 is due to 2791 deaths from 9/11).

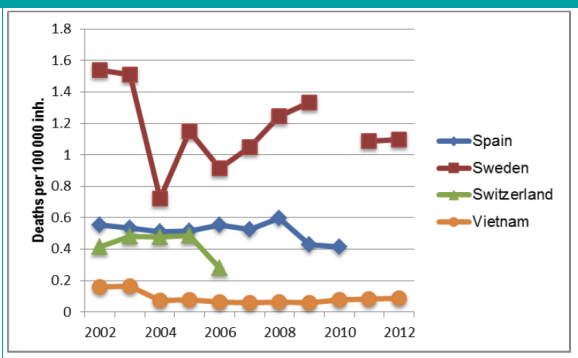

Figure 20 Fire death rates per capita in Spain, Sweden, Switzerland and Vietnam.

Source: International Fire Trends , 2016: SP Technical Research Institute of Sweden

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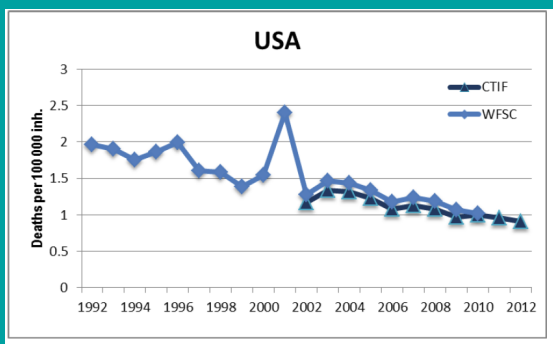

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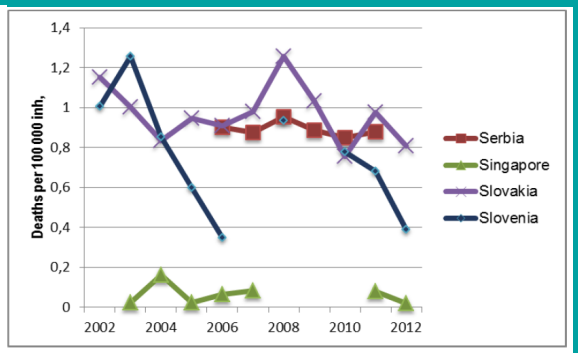

Figure 18 Fire death rates per capita Serbia, Singapore, Slovakia and Slovenia.

Source: International Fire Trends , 2016: SP Technical Research Institute of Sweden

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Number of Households in The Us:

1960: 52 Million
1975: 72 Million
2015: 135 Million

Source: US Census Bureau, 2015

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Number of Households in The Us with Smoke Alarms:

1960: Almost Zero
1977: 18 Million/22%
2010: 112 Million/96%

Source: NFPA, Smoke Alarms in US Fires 2015

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Number of Households in The Us with Ionization Smoke Alarms:

Approximately 90%-95%

101-106 Million Homes

Source: Industry Sales Figures/Research Report Estimates

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….. the home smoke alarm is credited as the greatest success story in fire safety in the last part of the 20th century, because it alone represented a highly effective fire safety technology with leverage on most of the fire death problem that went from only token usage to nearly universal usage in a remarkably short time.

Performance of Home Smoke Alarms
NIST Technical Note 1455-1
February 2008 Revision

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The Original Smoke Alarm Testing Standards Were Designed Around Providing Adequate Egress Time in 50% of Fires

That Means A Life-Safety Device Designed to Give Occupants a 5/50 Chance of Survival

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"Nationally, the percentage of people dying when the smoke detector works, but works too late, is approximately 40 percent,"

-Jay Fleming, Boston Deputy Fire Chief, CBS Boston Interview, 2007

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Let's Look Closer at Residential Fires,

Where They Start

When They Start

How They Start

And The Consequences

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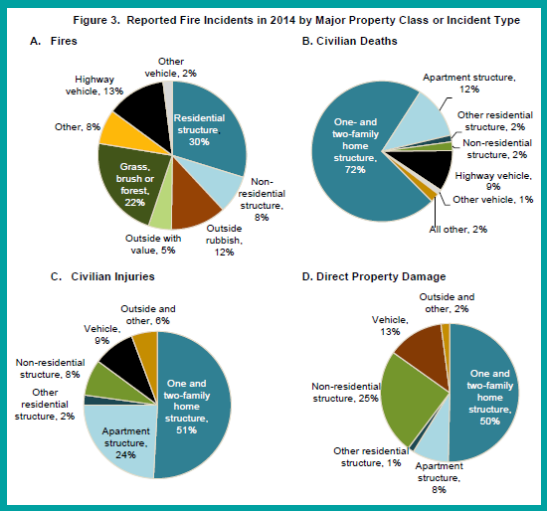

Source: Fire Trends , 2016: NFPA

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- **Most US Fire Deaths Occur at Home = 76.5%***
- **Most US Fire Injuries Occur at Home = 78%***
- **Most of Fire Prevention Budget Is Spent on Commercial**
  - Commercial = 99% (Estimate)
  - Residential = 1% (Estimate)

** Source: NFIRS Fire in US 17th edition, 2004-2013*

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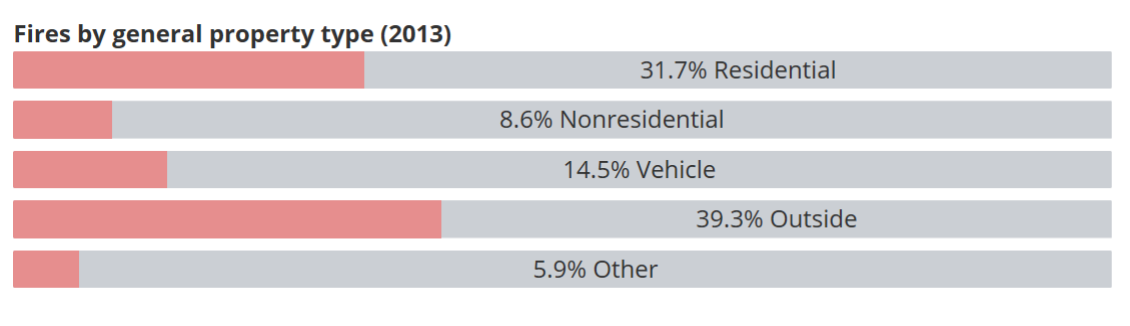

Source: Where Fires Occur, US Fire Administration/FEMA, 2016

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US Home Fire Deaths and Rate Per 1,000

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- 1977-2015 Fire deaths decreased from *5,865* to *2,560* a decrease of *56%*
- 1977-2015 The number of home fire incidents decreased of 49%

There is a decline death rate per 1,000 home fire of 16% for same period from 8.1 to 7.0

"…even though the number of home fires and home fire deaths declined similarly during the period, the death rate did not"

Source: NFPA Fire Loss, 2015

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Between 1977 and 2011 Hundreds of Millions of Residential Smoke Alarms Were Installed in the US.

In 1977, Around 22% of Homes Had At Least One Alarm

By 2011 Around 96% of Homes Have At Least One Alarm

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- **1977: Fires: 5,865 / Deaths / 1,000: 8.1**
- **2015: Fires: 2,5600 / Deaths / 1,000: 7.0**
- **Variance in Deaths, Per 1,000 Over 1977-2015**

High Approx. 9.7
Low Approx. 6.5

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- For Every One Residential Fire Death Approximately Five People Are Injured
- Many Injured Are Maimed/Scarred, Have Permanent Respiratory Damage, Etc.
- Injuries In Apartment Fires Are Higher – Roughly Nine to Ten Injuries Per Death

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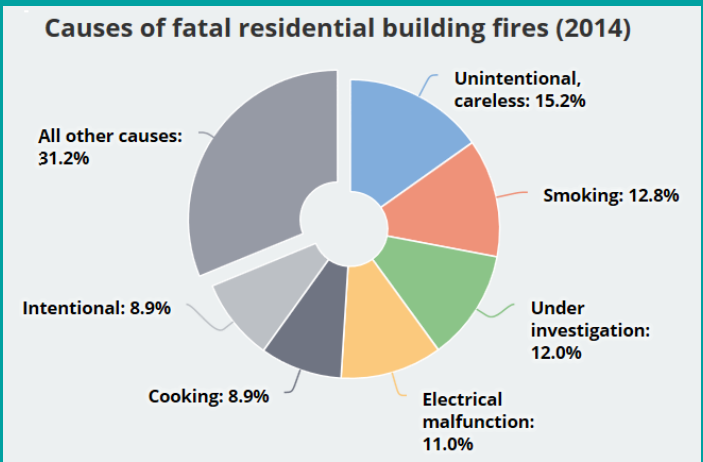

Cooking Fires Estimated At 8.9%

Smoking Estimated at 12.8%

Electrical 11.0%

Other 31.2%

Unknown/Under Investigation 12.0%

***Fatal** Fires By Source from US Fire Administration 2014*

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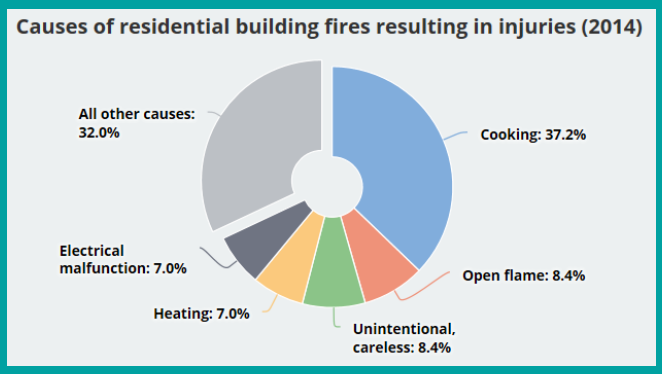

Injury Fires By Source from US Fire Administration 2014

Cooking/Open Flame Fires Estimated At 37.2%

Open Flame Estimated at 8.4%

Heating & Other Heat includes Space Heaters At 7.0 %

All Other 32.0%

Note: Pie Charts Divided Differently in Same Report

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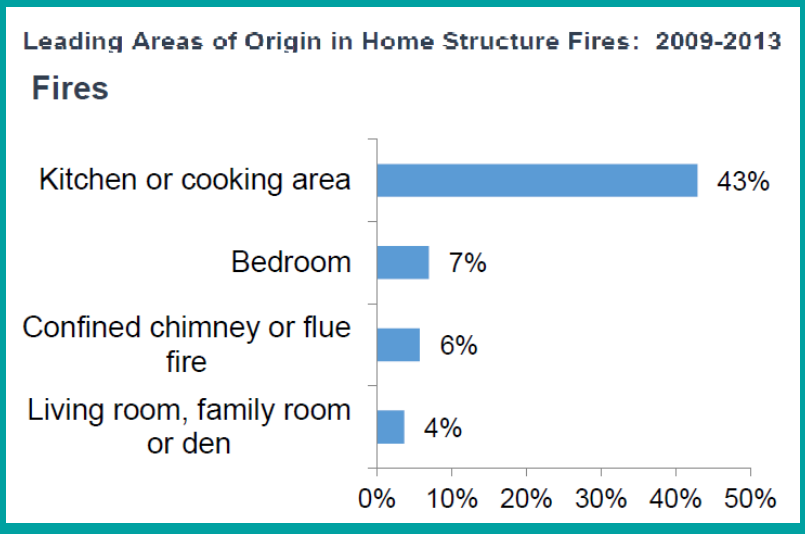

Source: Home Structure Fires, NFPA 2016

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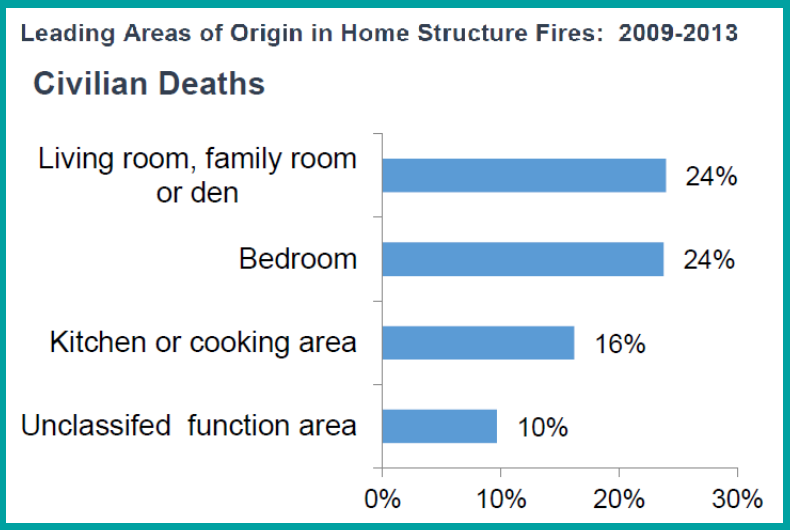

Source: Home Structure Fires, NFPA 2016

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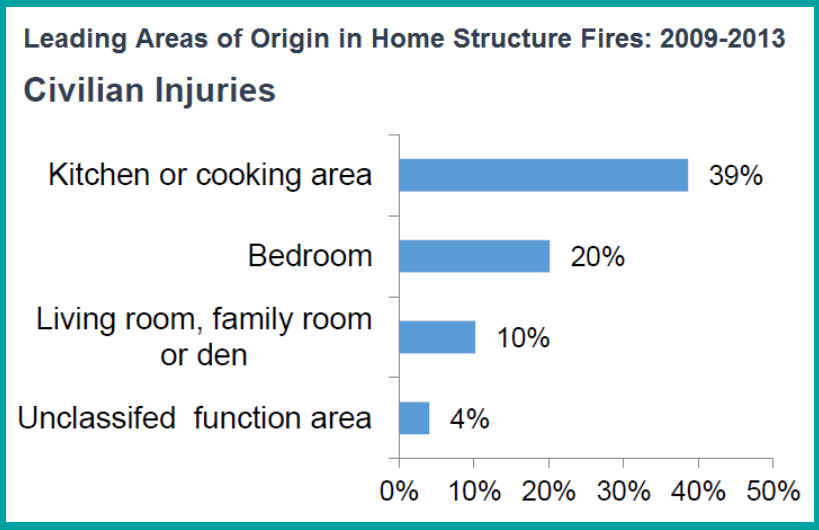

Source: Home Structure Fires, NFPA 2016

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- Cooking Fires Generally Open Flame/Fast Flame Fires
- Account For Largest Portion of Injuries but a Smaller Portion of Deaths
- Injured Person Is Generally "Intimate" With Fire
  - *Intimate = Present*
- Injuries Often Related to Suppressing Fire or Grease Etc.
- Some Argue That Smoke Alarms Offer No Protection Since You Don't Need It To Tell You That Your Stove Is On Fire When You Are Cooking

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- Smoking/Heater/Electrical Related Fires = Smoldering Fires
- Accounts For Largest Portion of Deaths and Smaller Portion of Injuries
- Injured Person Is Generally Unaware of Fire
- Injuries Related to Slow Exit, Smoke Inhalation, Return/ Heroics, Etc.

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- **Kitchen Fires Account For:**
  - 43% of Fires
  - 16% of Deaths
  - 39% of Injuries

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- **Living Room/Family Room/Den/ Bedroom Fires Account For:**
  - 11% of Fires
  - 48% of Deaths
  - 30% of Injuries

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Roughly 1 Out of Every 5 Deadly Fires Started in Upholstered Furniture

These Are Almost ALL Smoldering Fires

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- **Other Deadly Fire Criteria**
  - Smoking is Still a Leading Cause in Fatal Fire
  - Time of Day Matters
  - Age Plays a Strong Role
  - Location – Death Rates Vary Significantly By State

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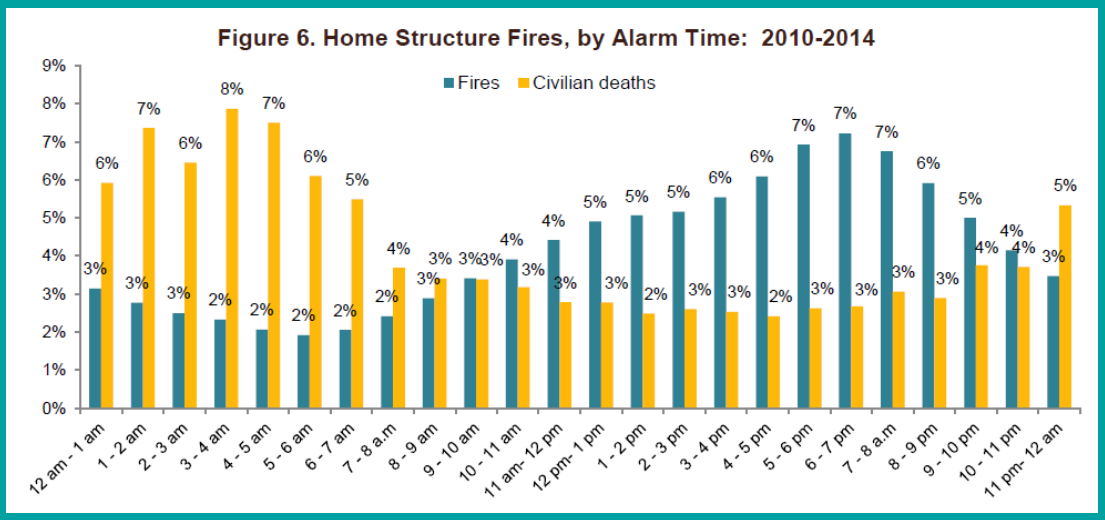

Source: Home Structure Fires, NFPA 2016

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Time of Day Matters!

- **37% of Fires Occur Between 8 PM & 8 AM**
- **65% of Fire Deaths Occur Between 8 PM & 8 AM**

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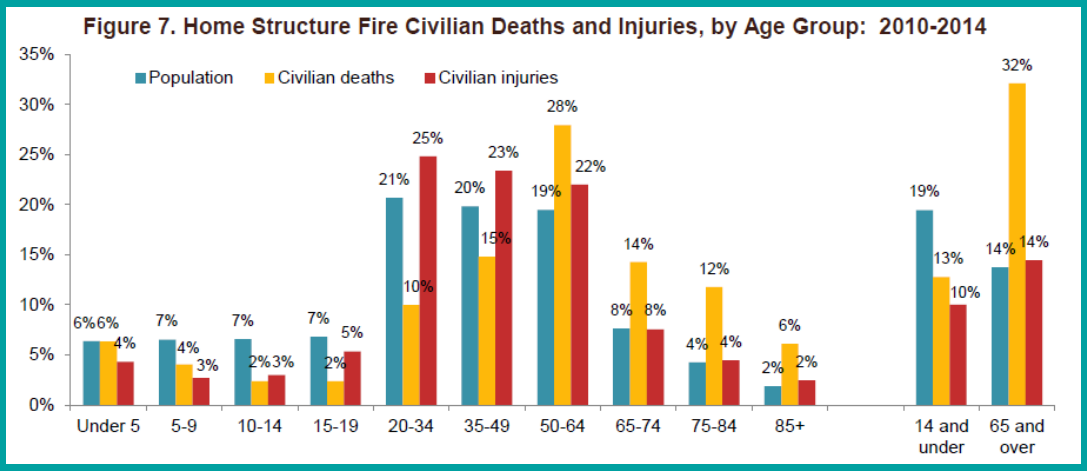

Those 85 and Older 3.3 times More Likely To Be Injured or Die in a Fire
Source: Home Structure Fires, NFPA 2016

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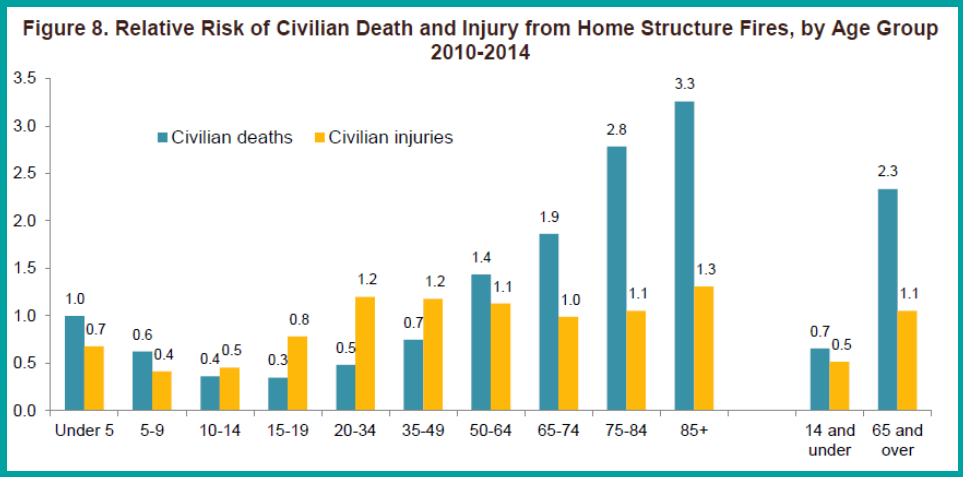

Relative Fire Death & Injury Risk By Age
Source: Home Structure Fires, NFPA 2015

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Age Impacts Survival Rate

- **National Average Death Rate = 8.0/Million**
- **"Older" Folks = 65+ Highest Risk**
  - 2.3 Times National Average
- **85+ Highest Risk = 3.3 Times Higher Than National Average**

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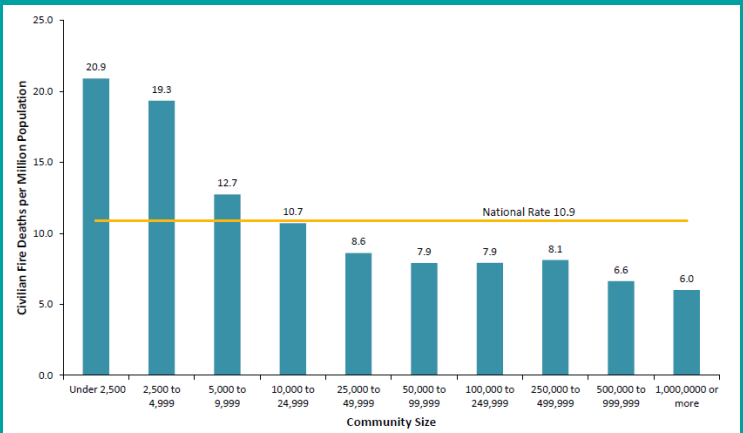

Figure 4. Civilian Fire Deaths per Million Population by Community Size, 2011-2015

Fire Death Rate is Generally Higher in Rural Areas Than Urban

Source: Fire Loss, NFPA 2015

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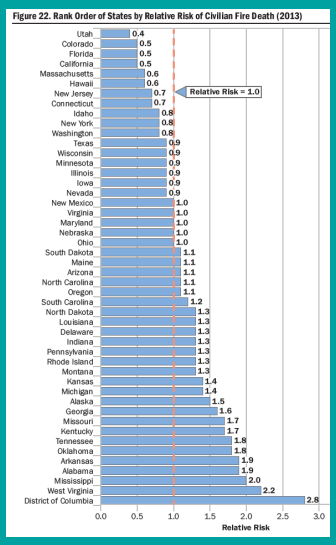

Utah = .4 Relative Risk

California = .5 Relative Risk

Massachusetts = .6 Relative Risk

New Mexico, Maryland, Virginia, Ohio, Nebraska = 1.0 Relative Risk

National Average = 1.0 Relative Risk

Beware:

West Virginia = 2.2 Relative Risk

District of Columbia = 2.8 Relative Risk

Source: Fire in the US 17th Edition, 2003-2014, US Fire Administration

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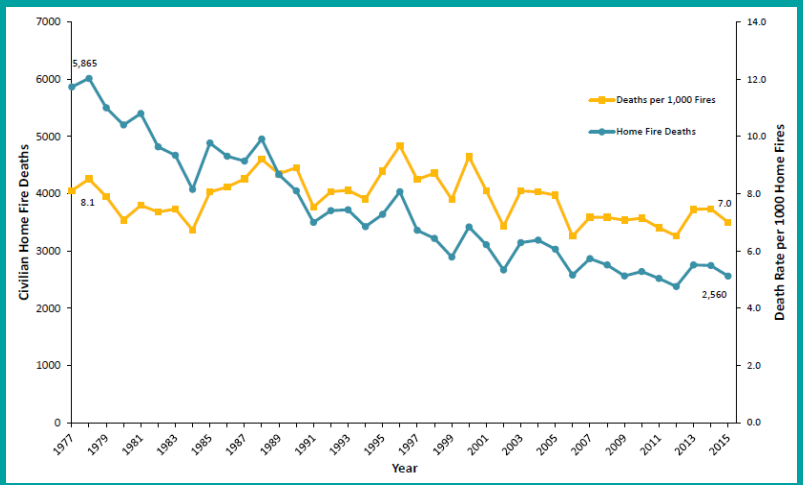
Residential Fires and Fire Deaths 1977-2015



Source: NFPA Fire Loss 2015

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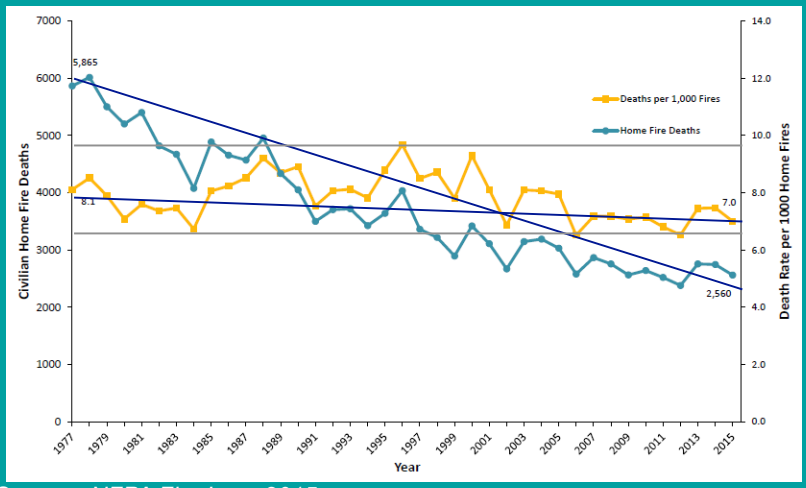
Residential Fires and Fire Deaths 1977-2015



Source: NFPA Fire Loss 2015

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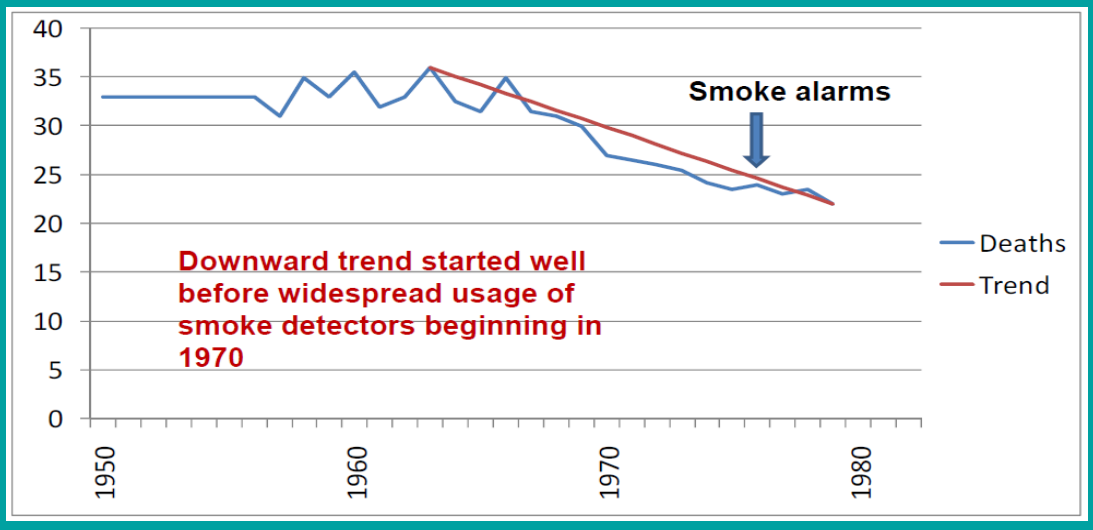

Source: National Safety Council

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Fires Involving People That Smoke:

- Smoking Related Fire Victims Are 3x More Likely to Be Intimate with Fire
- Proximity to Fire Means Less Likely to Be Saved By Smoke Alarms, Etc.
- Most Smoking Fires and 2/3's of Deaths Involve Trash, Mattresses, Bedding, Upholstered Furniture

Sources: US Fire Admin. "Behavioral Mitigation of Smoking Related Fires" FA-302 Feb 2006

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Fires Involving People That Smoke:

- In Smoking Fires – 25% of Victims Were Not The Smoker
- 34% of Other Victims Were Children
- 25% Were Neighbors (From Adjacent Units) or Friends
    - 14% Were Spouses

Sources: US Fire Admin. "Behavioral Mitigation of Smoking Related Fires" FA-302 Feb 2006

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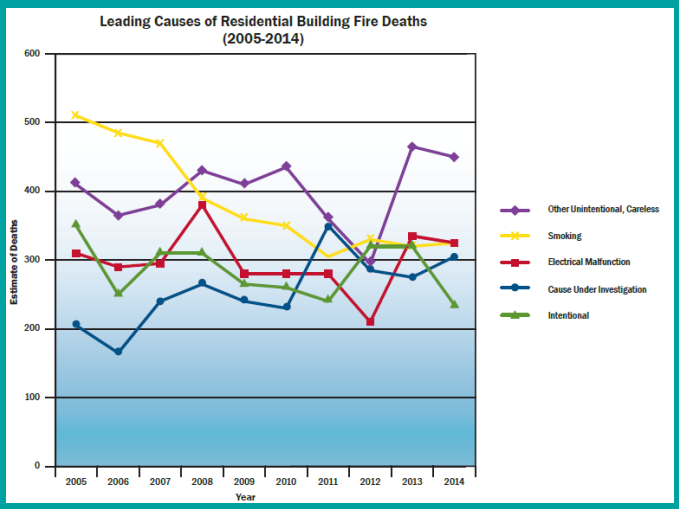

Overall, Smoking is the Second Leading Cause of Fatal Fires

Sources: US Fire Admin. "Residential Building Fire Trends, 2005-2014

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Fire Retardants Added to Mattresses, Furniture. Etc.:

- Retardant Use Controversial
  - Berkeley Professor
- Long-Term Impact Fire Retardants Seen in Rising Number of Fires Beginning with Ignition Other than Upholstered Furniture, Mattresses, or Bedding

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Fire Retardants Added to Mattresses, Furniture. Etc.:

Fatal Smoking Fires **NOT** Starting in Upholstered Furniture, Mattresses, or Bedding:

- 15% of Total in 1980
- 20% of Total in 1990
- 29% of Total in 2000

Sources: US Fire Admin. "Behavioral Mitigation of Smoking Related Fires" FA-302 Feb 2006

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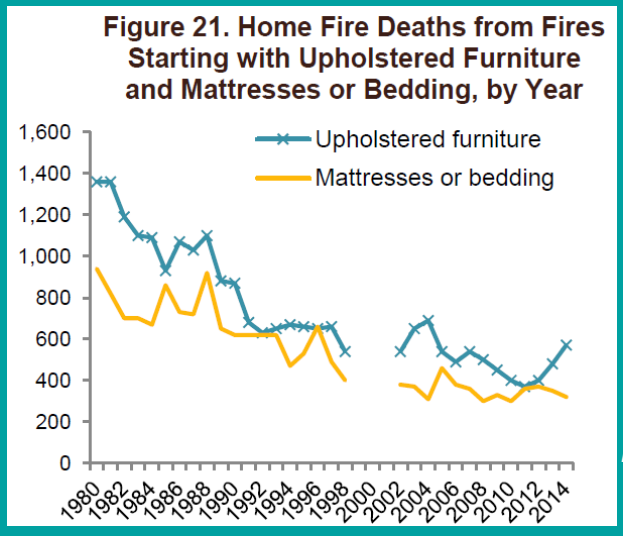

Note: Data Omitted for 1999-2002 Due to Transition to NFIRS 5.0

Source: Home Structure Fires, NFPA 2015

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Improved Building Codes and Inspections:

- Additional Requirements for Fire-Blocking, Draft-Stopping
- Separation Requirements Between Heavy Fire Load Areas and Living Spaces
- Generally More Sophisticated Inspectors

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Improvements in Electrical Wiring & Fire Related Construction:

- 90% of Electrical Fires Occur in Homes That Are 10 Years Old or Older (NFPA 73)
- Better Understanding of Fire Progression

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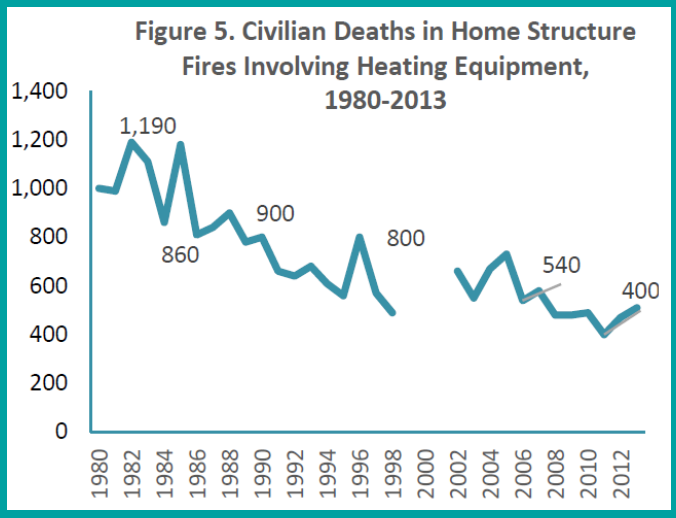
Home-heating deaths have decreased by over 60%:

- Safer Gas and Electric Heat Appliances
- Safety Devices on Portable Electric Heaters, etc.
- Still a Leading Cause of Residential Fires and Fatalities

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms



Note: Data Omitted for 1999-2002 Due to Transition to NFIRS 5.0

Source: Home Fires Involving Heating Equipment, NFPA 2016

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Dramatic Increase in Full Spectrum Burn Centers:

1975: 12 Full Spectrum Burn Care Units in US

1999: 100 Burn Care Units with 25 Full Spectrum Burn Care Units

"On a yearly basis, deaths, once the victim has been placed into the burn care system, have decreased from around 4,000 to 1,000"

Source: FEMA: America Burning: Recommissioned, May 2000

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Firefighters Use of SCBA:

"It has been my personal experience that Fire Fighters SCBA has made a significant contribution to victims survival rate."

**SCBA = Self Contained Breathing Apparatus*

Source: Photoelectric & Ionization Smoke Alarms Re-Visited
Jay Fleming, Deputy Fire Chief, Boston MA, Dec 2010

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

So, What Is The Point?

- There Are Many Reasons For The Drop In The Fire Death Rate
- The Drop In The Number Of Smokers Tracks Closest To The Drop In Fires and Fatalities
- The Installation Of Smoke Alarms Seems To Have Had Relatively Little Influence
- ***All Fires Do Not Carry The Same Risk!***

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Let's Look At Smoke Alarms

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Brief History of Smoke Alarms:*

1929: Walter Kidde Obtains First UL Listing for Shipboard Smoke Detector

1955: First Fire Alarms – Uses Heat Cue

1960's-1970's: Studies Determine That Smoke Sensors More Effective Than Heat

1965: First Single-Station Smoke Alarm – 120 VAC Photoelectric

1967: NFPA Founded

1970: First 9 Volt Powered Single Station Alarm Invented – Ionization Type

Mid-1970's: Smoke Alarm Sales Accelerate

1976: NFPA 101 – Life Safety Code Requires Smoke Alarms in Single Family Homes

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Brief History of Smoke Alarms:*

1973-1979: Model Codes Require Smoke Alarms in 1 & 2 Unit Dwellings

Mid-1970's: FHA/VA Require Smoke Alarms to Qualify for Funding

1976: UL 217 Smoke Alarm Test Developed

1977: Indiana Dunes Smoke Alarm Tests Conducted

1978: NFPA 74 Requires Every Level Coverage

1980: Half of US Homes Have at Least One Smoke Alarm

1982: Two-Thirds of US Homes Have at Least One Smoke Alarm

1984: Three-Quarters of US Homes Have at Least One Smoke Alarm

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Brief History of Smoke Alarms:*

1984: Model Codes Require One Alarm Per Level

1985: UL 217 Sensitivity Level Lowered to Reduce Nuisance Tripping

1988: Model Codes Call For Smoke Alarms in Bedrooms and Interconnected in New Construction

1989: NFPA 74 Requires Smoke Alarms to Be Interconnected in New Construction

1993: NFPA 72 Requires Smoke Alarms in Bedrooms in New Construction

1995: 10 Year Lithium Battery Smoke Alarm Introduced

1999: NFPA 72 Requires Replacement of Smoke Alarms After 10 Years

2009: Homes with at Least One Smoke Alarm - Approximately 95%

**Primary Source: White Paper, Private/Public Fire Safety Council, April 2006*

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Smoke Alarms/Detectors in Residential Construction

Smoke Detector:

Sensor Only, Connected to a Central System with Separate Annunciator/Horn

Smoke Alarm:

Single Station, Sensor and Annunciator/Horn in Single Package

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Smoke Alarms/Detectors in Residential Construction

In Residential Construction, The Two Smoke Alarm Sensor Technology Types Most Commonly Found Are:

Ionization

Photoelectric

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Residential Smoke Alarms/Detectors

- ***Alarms: Smoke/Fire Response Test: UL 217***
- ***Detectors: Smoke/Fire Response Test: UL 268***
- ***Canadian Standards Different***
  - *Generally More Strict*

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Ionization Alarms:

- Most Prevalent Alarm Sensor Type in US Market
- Approximately 95% of Single Station Alarm Installations
- Uses a Small Amount of Radioactive Material to Charge Air, Particles in Air Disrupt Current Flow and Set Off Alarm
- Detects Small Particle Sizes Well, .3 Micron and Less

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Differences Between Alarm Sensor Types:

Ionization:

- Detects Small, Fast Moving Particles Best
- Poor at Detecting Large, Slow Moving Particles
- Color and Density – Relatively Insensitive
- Nuisance Tripping: High

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Photoelectric Smoke Alarms:

- In US Market, Low But Growing Market Share
- Historically, 5% (Estimate) of Single Station Alarms
- Increasingly Manufactures Moving Residential Alarms to Photoelectric Only Products
  - Boston Has Photo Technology Ordinance – 70% of Sales

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Photoelectric Smoke Alarms:

- Uses an LED Light Source and Sensor
- Smoke Particles in Air Scatter Light onto Sensor and Set Off Alarm
- Detects Larger Particles Best, .5 Micron and Up

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Differences Between Alarm Sensor Types:

Photoelectric:

- Detects Medium/Large Particles Best
- Less Sensitive to Small Fast Moving Particles
- Color and Density – Insensitive to Colorless, Low Sensitivity to Black Particles, Detects Smoke Density Well

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Fire Types:

Fast Flame Fires:

- Flames Visible, Short Duration
- Found in Cooking Fires, Accelerant Based Fires, Last Stage Smoldering Fires
- Generates Small Fast Moving Particles

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Fire Types:

Smoldering Fires:

- No Flames Visible, Long Duration
- Found in Smoking Fires, Electrical Fires, Heating Fires, Upholstered Furniture
- Generates Medium/Large Slow Moving Particles
- Smoke "Aging"/Aglomeration

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL 217 Standard for Single Station Smoke Alarms:

- **The Theory Is Great**
- **Performance Based Standard**
- **Technology Independent**
- **The Problem Is The World Isn't Perfect**
- **Manufacturers Don't Want to Vote for a Standard That Their Product Can't Meet**
- **So the Standard Gets So Watered Down That Anything Can Meet It……**

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL STP 217:
UL Standards Technical Panel:

- **43 Members, Including 3 Non-Voting**
- **Responsible for Developing the Smoke Alarm Testing Standard**
- **Composed of 13 Producers/Manufacturers, 7 AHJ's, 6 Testing/Standard's including UL, 3 Consumer, 11 General - Academic/Fire/Etc.**
  - *Some General May Be Manufacturers or Industry Consultants*

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL STP 217:
UL Standards Technical Panel:

- **Requires 2/3's Vote to Change Standard**
- **Manufactures Have More Than 1/3 of Votes**
  - **Allows Producers To Effectively Block Any Change They Don't Want**

CodeCheck

Deadly Differences
Ionization vs Photoelectric Smoke Alarms

In a Nutshell…….
The Fox Is Watching The Hen House
***And the Guess Who Are the Hens*.**

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Deadly Differences
Ionization vs Photoelectric Smoke Alarms

How Do We Test Smoke Alarm Response Today?
Current UL 217 Test:

- Flaming Test
  - Uses Hepthane (Think Kerosene)
- Smoldering Test
  - Douglas Fir on a Hot Plate

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

How Do We Test Smoke Alarm Response Today?

Current UL 217 Test:

- Test Includes a Sensitivity Test Box
  - Literally a Wood Box with a Hot Plate and a Fan
  - *Induced Air Flow Across Alarm at 32/fpm – Why?*
  - *Materials and Conditions Not Representative of Real World Conditions*
    - *And Really Never Were*

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

How Do We Test Smoke Alarm Response Today?

UL 217 Test Box:

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

How Do We Test Smoke Alarm Response Today?

UL 217 Test:

Is It Really Surprising That We Have Alarm Performance Issues?

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

How Do We Test Smoke Alarm Response Today?

Current UL 217 Flaming Test:

- Alarm Must Trigger at .5%-10.0%/ft O.D.
- Alarm Must Trigger Within 240 sec
- Open Flame Test Using Hepthane (think Kerosene, etc.)

Note: O.D. = Optical Density

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

How Do We Test Alarm Response Today?

Current UL 217 Non-Flaming Test:

- Alarm Must Trigger at .5%-10.0%*/ft O.D.
- Uses Douglas Fir on a Hot Plate
- With A Fan Blowing Smoke at Smoke Alarm
  - "Directionality Test" – Why?

** Estimated Max. O.D. for UL 217 Non-Flaming Test*

Note: O.D. = Optical Density

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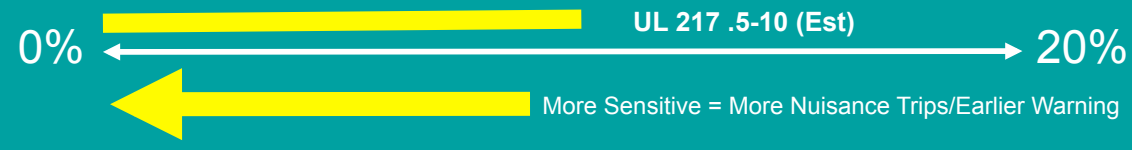
Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Smoke Optical Density/OD To Trigger



High	*Nuisance Tripping*	Low
High	*Tenability*	Low

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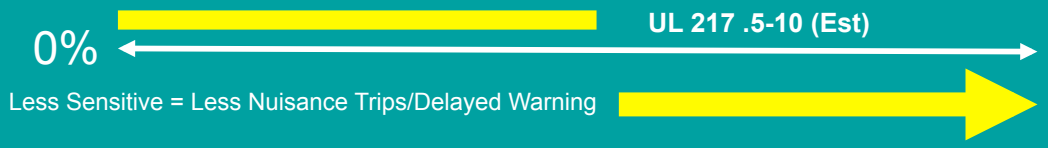
Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Smoke Optical Density/OD To Trigger



Less Sensitive = Less Nuisance Trips/Delayed Warning

High	*Nuisance Tripping*	Low
High	*Tenability*	Low

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Factory Alarm 4%-7%/M OD (NIST Dual Alarm 2009

High	*Nuisance Tripping*	Low
High	*Tenability*	Low

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Reason	%
Removed, Nuisance	32
Forgot to Replace	30
Alarmed Continuously	7
Never Looked	5
No Batteries in House	5
Removed Batteries for Other Use	4
Hadn't Had a Chance to Install	4
Detector Malfunctioned	3
Wasn't Properly Connected	3
Battery Type Unavailable/Costly	2
House Repair/Removed Temporarily	2
Waiting for Someone to Install	1
Other Reason	8
Don't Know/No Answer	18
Total	124

CPSC Reasons for Disabling Alarms: 1992 Study of 1000 Households

Half of Intentional Disconnects Due to Nuisance Trips

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Pending UL 217 Modification:

- ***It Took 19 Years to Get This Through the 217 Committee***
- Eliminates Old Flaming and Smolder Tests
- Adds Polyurethane Foam Flaming and Smoldering Test
- Removes Lower Trip Limit of .5% O.D.
- Adds Nuisance Alarm Test
  - ***Finally!!!***

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Pending UL 217 Modification:

- ***Approved in Oct. 2015***
- ***Two Years Before It Becomes Effective – Oct. 2107***
  - *Assuming It Isn't Modfied In Meantime*
- ***Manufacturers Allowed to Sell Inventory in Supply Chain***
  - *It Could Take Several More Years Before Old Alarms Are "Flushed" From System*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

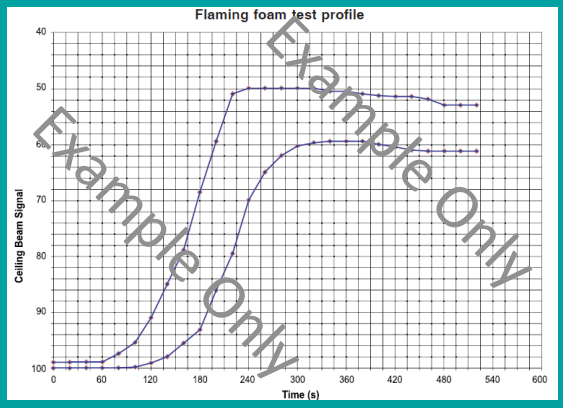
Pending UL 217 Modification:

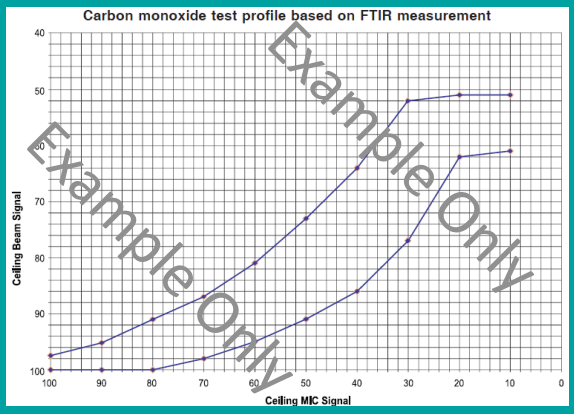
- ***Proposed Flaming PU Test:***
  - PU Ignited to Create Open Flame
  - Maximum 5% O.D.
  - Maximum MIC Per Table
  - PU Foam – No Colorants/Fire Retardants (Not Real World)
  - Valid Test Falls Inside UL Test Profile – See Next Slide
  - Controlled Ambient Temperature, Material Moisture Content and Composition

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms





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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

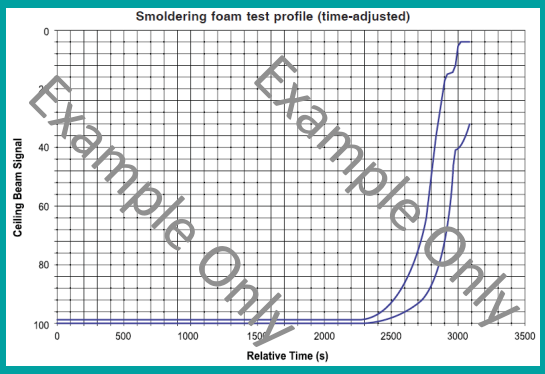
Pending UL 217 Modification:

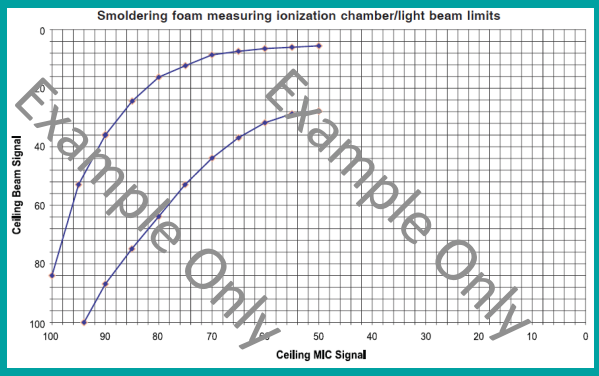
- ***Proposed Non-Flaming PU Test:***
  - PU Induced to Smolder Without Transitioning to an Open Flame – Several Methods Allowed
  - **O.D. Cannot Exceed 12% - Higher Than Current**
  - Maximum MIC Per Table
  - PU Foam – No Colorants/Fire Retardants (Not Real World)
  - Valid Test Falls Inside UL Test Profile – See Next Slide
  - Controlled Ambient Temperature, Material Moisture Content and Composition

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms





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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Pending UL 217 Modification:

- ***Proposed Nuisance Test:***
  - Uses Broiled Hamburgers
  - Alarm Cannot Trip at Less Than 1.5% O.D.
  - Maximum MIC Per Table
  - Maximum CO Based on Time
  - Alarms Placed 10 ft. from Cooking Source
  - Valid Test Falls Inside UL Test Profile – See Next Slide
  - Controlled Ambient Temperature, Hamburger Composition

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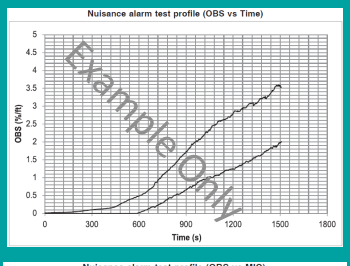
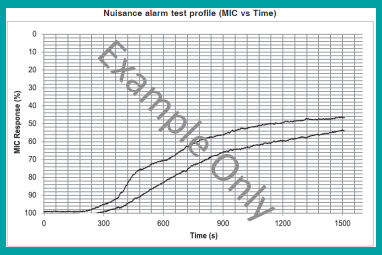
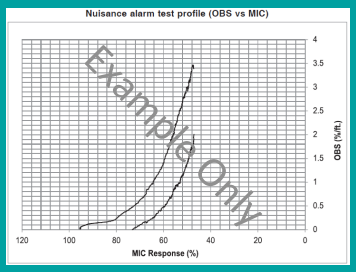
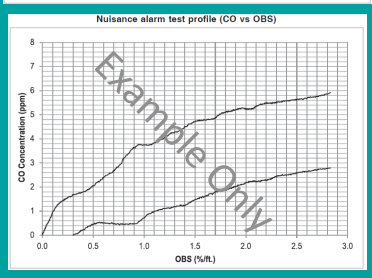
Deadly Differences

Ionization vs Photoelectric Smoke Alarms









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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Pending UL 217 Modification:

- ***On Oct 7, 2016 Proposed Change Made to Pending Test:***
  - Adds Placement of CO Monitor
  - Implications As To Implementation Date Uncertain
  - One Producer Is Lobbying For Certain Alarms to Be Exempted from Nuisance Test

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Pending UL 217 Modification:

- Some Insiders Think Ionization Alarms Will Not Be Able to Pass Nuisance Test
- If This Happens – It Should Be The End For Stand-Alone Ion Alarms
- That Means You Can Recommend Upgrading Old Alarms Just Like Recommending Upgrades to GFCI
- ***This Will Not Happen Overnight***

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

What About Combination Alarms?

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Definition of Combination Alarm

NFPA 72/2013

A.3.3.66.4 Combination Detector. These *detectors do not utilize a mathematical evaluation* principle of signal processing more than a simple *"OR"* function. Normally, these detectors provide a ***single response*** *resulting* ***from either sensing method***, **each** of which ***operates independent of the other***. These devices can provide a separate and distinct response resulting from either sensing method, each of which is processed independent of the other.

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Combination Alarms

- **Two or More Sensing Devices, Ion, Photo, CO, etc.**
- **Shared Power Source/Horn In One Case**
- **"*OR*" Logic: First Sensor to Trigger Makes Noise**
  - *Smoke Alarm Performance Should Be Identical To Separate Ion and Photo Alarms – All Other Things Being Equal*

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST: Performance of Dual Photoelectric/Ionization Smoke Alarms in Full-Scale Fire Tests / 2009

...Examines data from two full-scale smoke alarm fire tests to provide some insight into the performance of dual photoelectric/ionization alarms as compared to individual photoelectric or ionization alarms. The two test series are the NIST home smoke alarm tests and the National Research Council (NRC)

The analysis presented below focuses on a **single aspect** of alarm performance: the **time to alarm** during exposure to various fire smokes

No consideration was made to account for **tenability** conditions anywhere in the homes, nor any **egress** scenarios. Furthermore, nuisance alarm susceptibilities that may factor into the overall alarm performance were not considered.

NIST SupDet/Cleary 2009

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Combination Ion/Photo Alarms:

NIST :

The **alarm logic is an {OR}-type** such that the alarm is activated if either the photoelectric sensor or ionization sensor alarm threshold is met. The **individual sensor sensitivities are not tested separately.** Therefore, manufacturers have the freedom to set each sensor's sensitivity separately. **Since an individual sensor can be set to meet all current sensitivity standards, it is not obvious what overall benefit is achieved from a dual alarm** with an additional sensor technology that could be more or less sensitive than what would be found in a standalone unit employing such a sensor.

NIST SupDet/Cleary 2009

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:

Photoelectric Sensitivity Estimated at 6.6%

- Sensor Calibration and Variability Not Measured

Ionization Sensitivity Set Manually to 2.6%, 4.3%, 5.9%

- All Ion' Sensors Modified – 2.6 Is Lower Than Manf. Settings
- Sensor Variability Measured – Sensor Accuracy Appears to Vary Between +- 1.5% to 5%

NIST SupDet/Cleary 2009

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:

These statistics (Canadian) lead to the conclusion that the dual photoelectric sensor and the photoelectric alarm had nominally the same alarm sensitivity settings, and conversely, **the ionization sensor in the dual alarm was more sensitive than the ionization alarm sensor**. Also, one can conclude that **some of the benefit** of the dual alarm **used in this study can be attributed to a more sensitive ionization sensor**, compared to the stand-alone ionization alarm.

Alarm Type	Average Alarm Time (s)	Median Alarm Time (s)	Standard Deviation (s)
Ionization (2.6 %/m)	107	107	35
Ionization (4.3 %/m)	113	113	36
Ionization (5.9 %/m)	118	118	36
Photoelectric	143	149	33
Dual 1 (2.6 %/m)	105	107	29
Dual 2 (4.3 %/m)	109	112	30
Dual 3 (5.9 %/m)	114	115	29

Table 3. Alarm time statistics for the NIST test series of initially flaming fires (36 instances). Shaded entries highlight sensitivity settings used in the NIST report analysis.

Results of Three Flaming Tests

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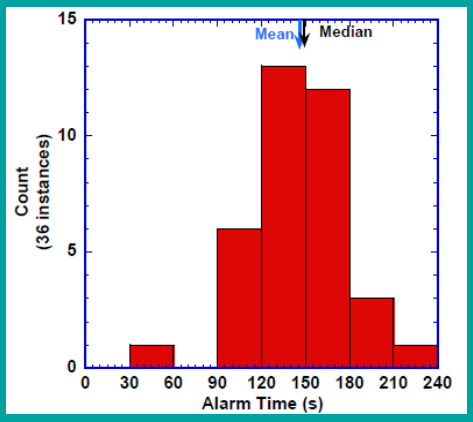
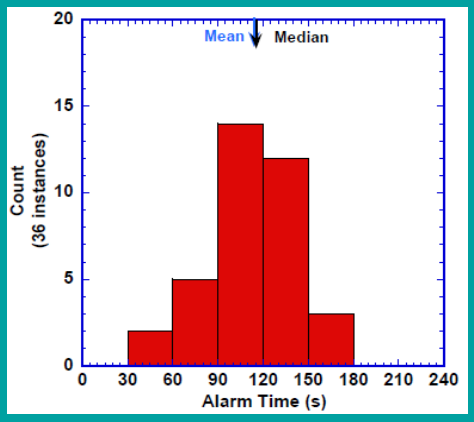
Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:



Photoelectric/Flaming – 6.6%



Dual/Flaming – Low Sen/5.9%

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:

Table 4 gives the mean, median and standard deviation of the alarm times for initially smoldering fires with the bedroom door opened. Figures 10-13 show histograms of the alarm times of the middle sensitivity ionization alarm, photoelectric alarm, dual 1 alarm configuration, and dual 3 alarm configuration for this set of tests. **The dual alarm configurations yielded much faster average alarm times than the ionization alarms and average alarm times nearly equivalent to the photoelectric alarm.**

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:

Alarm Type	Average Alarm Time (s)	Median Alarm Time (s)	Standard Deviation (s)
Ionization (2.6 %/m)	4228	4213	1282
Ionization (4.3 %/m)	4281	4242	1343
Ionization (5.9 %/m)	4296	4244	1350
Photoelectric	3656	3753	1558
Dual 1 (2.6 %/m)	3652	3749	1554
Dual 2 (4.3 %/m)	3653	3751	1555
Dual 3 (5.9 %/m)	3653	3751	1555

Table 4. Alarm time statistics for the NIST test series of initially smoldering fires (35 instances). Shaded entries highlight sensitivity settings used in the NIST report analysis.

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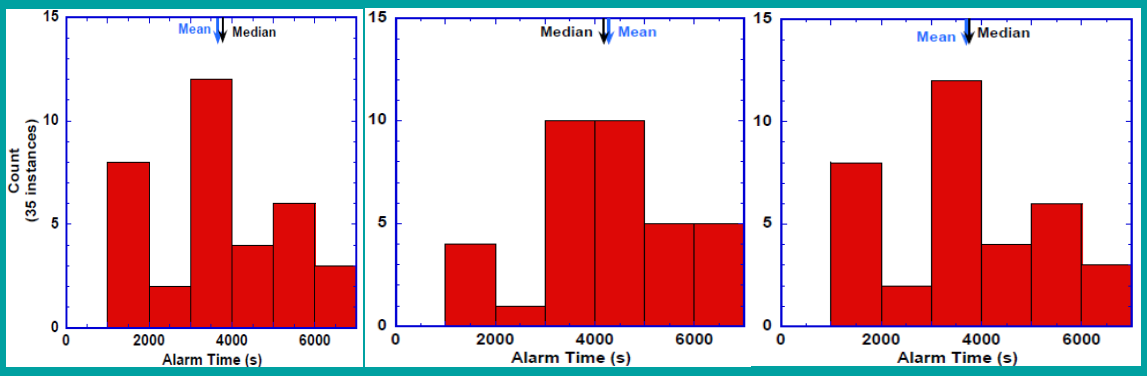
Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:



Photoelectric/Smoldering – 6.6% Ion/Smoldering Dual/Smoldering - Low Sen/5.9%

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST Dual Alarm Study:

Report Conclusions:

3) Over the sensitivity range examined in the NIST study, **dual alarms exhibited almost no average decrease in alarm time compared to photoelectric alarms during initially smoldering fire scenarios**, irrespective of the ionization sensor sensitivity (4 s to 3 s from high to low sensitivity settings). **Dual alarms exhibited a pronounced average decrease in alarm times compared to photoelectric alarms for initially flaming fire scenarios** (38 s to 29 s from high to low sensitivity settings). For the kitchen fires, the average decrease in alarm time was a strong function of ionization sensor sensitivity (197 s to 18 s from high to low sensitivity settings). **For the fires with the bedroom door closed, dual alarms exhibited a sustained average decrease in alarm time compared to photoelectric alarms** (103 s to 94 s from high to low sensitivity settings).

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Dual Alarm Study Points to Consider:

The report illustrates that when a dual alarm responds faster in a smoldering fire – it is because the photoelectric portion is set to a more sensitive setting that a standalone photoelectric alarm

When a dual alarm responds faster in a flaming fire – it is because the ionization portion is set to a more sensitive setting that a standalone ionization alarm

The tests set ionization alarms to settings that are more sensitive than those available in commercially available alarms

The tests did not consider the impact of sensitivity on nuisance tripping and consequently – intentional disconnects

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

More Simply Put:

If You Take Something That Works and Combine It With Something That Doesn't,

How Can The Combined Device Be Better?

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Tenability Criteria:

Tenability, An Estimate of When the Environment Becomes Too Hazardous to Safely Allow Egress

NIST Smoke Alarm Tests Used the Following Criteria for Tenability:

Temperature: Greater Than 88° C/190° F

CO Gas Concentration: Range: .02%-.03%

Smoke Obscuration: O.D.* Less Than/Equal to .25%/M

**O.D. = Optical Density*

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Some Terms/Acronyms Used in Test Results:

ASET = Available Safe Egress Time

RSET = Required Safe Egress Time

Untenable = Condition Will Not Support Life Without Special Equipment

Flashover = Simultaneous Ignition of Combustible Materials In an Enclosed Area

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Important Facts to Keep in Mind:

Cooking/Fast Flame Fires Account for:

43% of Fires, **39%** of Injuries and **16% of Deaths**

Smoldering Fires Account for:

23% of Fires, 30% of Injuries and **61% of Deaths**

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Important Facts to Keep in Mind:

Nearly *Two-Thirds of All Residential Fatalities* Occur In Homes With Either *No Alarm* or *Non-Functional Alarms*

US Homes with **No** Smoke Alarm Installed – *About 4%*

Roughly *96% of "No Functional Alarm" Fire Deaths Occur in Homes with Smoke Alarms That Are Not Functional*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Now Let's Take Look at A Number of NIST/ NFPA/UL/University/Canadian/UK/ Norwegian Tests and Results Comparing the Performance of Ionization and Photoelectric Alarms Under Various Fire Conditions

This is Where the Rubber Hits the Road.....

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Studies/Tests/Articles over a 30 year period

All Published and Available for Review

All Reputable Sources

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Factory Mutual Study (Heskestad)***
Year:	*1974*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*> 30 Mins*
Comments:	*Ion Good for Flaming/Bad for Smoldering* *Photo Good for Smoldering/Bad for Flaming*

Ion Flaws Inherent/Not Fixable

Photo Flaw Fixable by Correcting Smoke Entry Issues – Was Fixed in Early 80's

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***Indiana Dunes Test***

Year: *1976*

Used Synthetic Material: *No*

Duration of Smoldering Test: *> 30 Mins*

Comments: *Smoke Detectors Better Than Heat Detectors, One Per Level Desirable*

Note: Dunes Test Was Actually Three Separate Tests

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: *Massachusetts* ***Analysis of Dunes Test***

Year: *1976*

Used Synthetic Material: *N/A*

Duration of Smoldering Test: *N/A*

Comments: *Analysis of Dunes Data Only - A Detector Per Level Will Provide 3 Min Escape Time 89% of Time*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Edmonton Fire Dept Test***
Year:	*1976*
Used Synthetic Material:	*Unknown*
Duration of Smoldering Test:	*> 60 Mins*

Comments: Both Ion and Photo improve life safety/survival rates

In smoldering fires, Ion's may go off too late

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Minneapolis Fire Dept Test***
Year:	*1978*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*< 10 Mins*

Comments: Both Ion and Photo's gave good early warning if smoke could reach detector

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Cal Chiefs/LA Fire Dept Test***
Year:	*1978*
Used Synthetic Material:	*Yes – Modern Furniture Used*
Duration of Smoldering Test:	*> 30 Mins*

Comments: Smoke Detectors More Reliable than Heat Detectors. NIST Concluded Both Adequate. LAFD & IAFC Favored Photo's Based on Results

Note: IAFC = International Association of Fire Chiefs

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***UK Fire Res Station Test***
Year:	*1978*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*> 30 Mins*

Comments: Both Ion & Photo Smoke Detectors Respond Rapidly to Flaming Fires. Ion's Were Not Adequate in Smoldering Fires

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***Australian Smoldering Test – Pub in Fire Tech Mag***

Year: *1986*

Used Synthetic Material: *Yes*

Duration of Smoldering Test: *< 10 Mins*

Comments: Photo's Provide Adequate Escape Times in Most Fires. Ion's Generally Inadequate Escape Times

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***Norwegian Fire Research Lab Study***

Year: *1993*

Used Synthetic Material: *Yes*

Duration of Smoldering Test: *> 30 Mins*

Comments: Ion's Are Inadequate for Smoldering Fires. Ion's Only 15-20 Sec Better Than Photo's in Flaming Fires. Advantage Only Beneficial in Extraordinary Circumstances

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***Texas A&M Risk Analysis of Res Fire Detector Performance***

Year: *1995*

Used Synthetic Material: *N/A – Analysis of Prior Data*

Comments: Took Previous Major Studies plus Texas A&M 2 1/2 Year Fire Simulation Study. Built a Risk Model to Estimate Failure to Alarm Rates Based on Fire Incident Reports/Types and Smoke Alarm Types

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Texas A&M Risk Analysis of Residential Fire Detector Performance

Final Texas A&M Report Conclusions:

Ionization Alarm Smoldering Failure Rates: 55.80%

Photoelectric Alarm Smoldering Failure Rates: 4.06%

Meaning Ionization Alarms Work About 45% of Time

While Photoelectric Alarms Work 96% of Time

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Texas A&M Risk Analysis of Residential Fire Detector Performance

Final Texas A&M Report Conclusions:

Ionization Alarm Flaming Failure Rates: 19.80%

Photoelectric Alarm Flaming Failure Rates: 3.99%

Meaning Ionization Alarms Work About 80.2% of Time

While Photoelectric Alarms Work About 96% of Time

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Texas A&M Report

- ***Results Largely Ignored By NIST, NFPA, CPSC, Etc.***
- ***Not Referenced in Maryland, California or Ohio SFM Taskforces***
- ***Yet, Results Compare Well to Newer Studies***

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***UK Smoke Alarms in Typ Dwelling – Part I***
Year:	*1997*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*> 30 Mins*

Comments: Ion's Cannot Be Guaranteed to Detect Smoldering Fires. Ion's Better Than Photo's in Flaming Fires. Advantage Could be Critical

Note: Fires Smoldered > 30 Mins

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***UK Practical Comparison of Smoke Alarms – Part II***
Year:	*1997*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*< 15 Mins*

Comments: Both Ion's and Photo' Adequate.

Note: Fires Smoldered < 15 Mins. There Was an Unexplained Change in Way Researchers Ignited Fires

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Simplex Study***
Year:	*2001*
Used Synthetic Material:	*UL 217 Test*
Duration of Smoldering Test:	*UL 217 Test*

Comments: Ion's Slightly Better in Flaming Fires. Photo's Provide Clear Advantage in Smoldering Fires.

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***Kermano Fire Study***
Year:	*2003*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*< 15 Mins*

Comments: Combination Alarms Worked Best. Ion's Best for Flaming Fires. Photo's Best for Smoldering Fires. All Gave Adequate Evacuation Times.

Note: Alarms Used Were UL-Canada – ULC Standard Is Different than US Standard i.e. More Sensitive

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***NIST Fire Study***
Year:	*2003*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*N/A – Variety of Scenarios*

Comments: "Both common residential smoke alarm technologies (ionization and photoelectric) provided positive escape times in most fire scenarios".

Note: Ion Alarms Provided a -43 sec, -54 sec and a +16 Escape Time in Two of the Deadliest Fire Scenarios. Positive Escape Time Does Not Equal Enough Time to Escape

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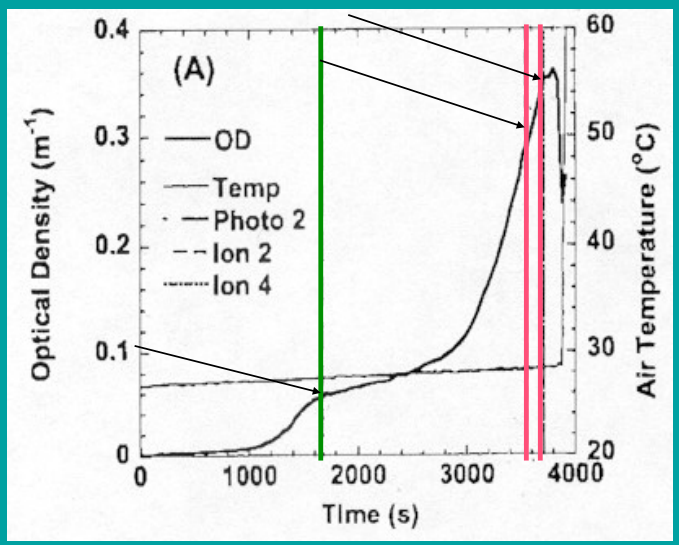
Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST 2003:

Fig 1: Test 34
Smoldering Fire
In Living Room

Note: This is one of the deadliest fire scenarios



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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST 2003:

Data for Previous Slide – Note Ion Response Far Exceeds UL Required Upper Response Threshold of 10% O.D.

TABLE 3 – RESPONSE CHARACTERISTICS (TEST 34)

DETECTOR TYPE	RESPONSE TIME	%OBSCURATION AT RESPONSE
Photoelectric	1600 secs	3-4% obsc/ft
Ionization	3550 secs	17-19% obsc/ft
Ionization	3700 secs	20-22% obsc/ft

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST 2003:

TABLE 1 - AVAILABLE SAFE EGRESS TIME (PAGE 242)
(Manufactured Home)

	Photoelectric	Ionization
Flaming		
Living Room	85	142
Bedroom	58	93
Bedroom (Door Closed)	451	898
Smoldering		
Living Room	172	-43 ←
Bedroom	1091	82
Cooking		
Kitchen	575	821

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

NIST 2003:

TABLE 2 - AVAILABLE SAFE EGRESS TIME (PAGE 243)
(Two-Story Home)

	Photoelectric	Ionization
Flaming		
Living Room	108	152
Living Room(Replicate)	134	172
Living Room(Fully Furnished)	144	172
Bedroom	---	374
Bedroom (Door Closed)	3416	3438
Smoldering		
Living Room	3298	16
Living Room (Air Conditioned)	2772	-54
Bedroom	135	135
Cooking		
Kitchen	952	278

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Public Testimony :

Agency: ***NIST Public Statement to Boston City Council***
Year: *2004*

However, ***ionization detectors*** have been shown to ***sometimes fail to alarm in a smoldering fire even when visibility in the room is significantly degraded*** by smoke. Most photoelectric detectors alarm substantially sooner in these situations. In the ***NIST experiments the photoelectric detectors sensed smoldering fires on average 30 minutes earlier*** than the ionization detectors. The same study demonstrated that ionization detectors responded, on average, 50 seconds earlier than photoelectric detectors during flaming fire experiments. *The **relative margins of safety** associated with a **30 minute** earlier warning in a slow growing smoldering fire compared to a **50 second** earlier warning for a fast growing flaming fire is **difficult to determine**.*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***NIST Fire Study***

Year: *2008*

*Used Synthetic Material: Variety of Materials Flame/**Smoldering***

Comments: All Alarms Responded in Flame Tests within Stds.

Wood Smolder Test: Photoelectric alarms reached thresholds earlier and at more locations than ionization alarms

*Polyurethane Foam Smolder Test: The propensity was for photoelectric alarms to reach threshold values during smoldering, and **all alarms to reach thresholds after transition to flaming.***

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency: ***FEMA Smoke Alarm White Paper***

Year: *2006*

Used Synthetic Material: *N/A – Limited Field Test Only*

- *Comments: 24% of US Households Surveyed Had Either No Alarm or Non-Functional Alarm – Accounts for 2/3's of Fire Deaths*
- 50% of Households with Non-Functional Alarms Cited Nuisance Trips as Reason for Disabling

  Also Looked at Age, Race, Income Levels vs Risk
- *97% of Nuisance Alarms Were Ionization Alarms (**NFPA/NIST/CPSC)*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL Smoke Characterization Project:

The Study Collected Data on Smoke Characteristics such as:

Particle Size, Particle Color, Heat Generation, Gas Generation
Under UL 217 Test Conditions

Table 25 Summarizes the Results of Residential Ionization and Photoelectric Alarm Response Times to the Materials Tested in Non-Flaming/Smoldering Conditions (UL 217)

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL Smoke Characterization Project:

Other Smoldering Fire Results:

Smoldering Ponderosa Pine, a UL 217 Test Material:

In 217 Test - Photoelectric Alarms - 2.3% Faster (Basically the Same

Ionization Alarms Did Not Respond in 1 of 5 UL Test Materials
A 25% No Alarm Rate

Bread/Toaster: Ionization Alarms 22% Faster Response

In Other 8 Smoldering Test Synthetic Material Scenarios:

Ionization Alarms Did Not Respond Properly During the Tests

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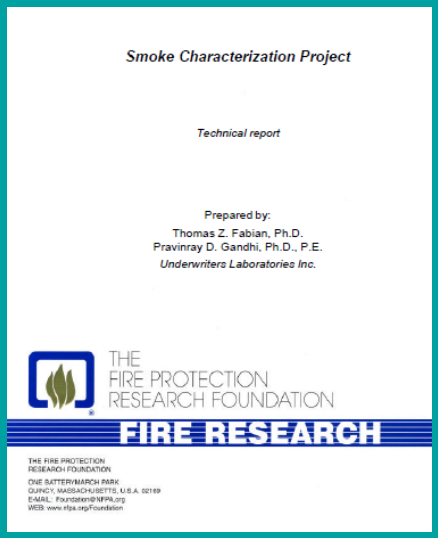
Deadly Differences

Ionization vs Photoelectric Smoke Alarms



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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Smoke Alarm Response to Non-Flaming Fires

The photoelectric alarm activated first in the non-flaming tests with the exception of the higher energy bread/toaster test **in which the ion alarm activated first. The UL 217 smoldering Ponderosa pine test triggered both the ionization and photoelectric smoke alarms.** ***For many of the other materials, the ionization smoke alarm did not trigger*****. In each of these cases, the obscuration value was less than the 10 %/ft limit specified in UL 217. It was also found that there was settling of the smoke particles in the test room over time. Measurements from several non-flaming tests showed that the obscuration values at the ceiling dropped over time, and the maximum obscuration values were observed at the 2 feet measurement location below the ceiling.**

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Table 25 – Non-flaming mode alarm response times

Target Sample Description	Test No.	Ion Alarm Trigger Time (s)	Analog Signal Value MIC (pA)	Analog Signal Value Photo (mV)	Photo Alarm Trigger Time (s)	Analog Signal Value MIC (pA)	Analog Signal Value Photo (mV)
UL 217 Ponderosa pine	12126	3244	63.9	71.1	3226	63.9	72.0
	12132	DNT	--	--	3318	73.4	76.4
	12143	3826	66.0	74.3	3805	68.2	75.0
	12184	3547	66.0	70.1	3451	71.6	75.9
	12185	2894	64.6	73.6	2722	72.3	79.1
Bread – 4 slices	12133	319	66.1	98.0	364	45.9	55.5
	12155	306	71.5	99.4	371	41.5	45.8
	01244	343	75.8	98.5	448	28.4	19.4
Polyisocyanurate insulation – 150 × 150 × 200 mm pieces	12271	DNT	--	--	DNT	--	--
Mattress PU foam – 150 × 150 × 50 mm foam	12192	DNT	--	--	DNT	--	--
	12193	DNT	--	--	DNT	--	--
Mattress PU foam – 100 × 125 × 100 mm foam with a 25 × 150 × 150 mm piece on two opposing sides	12202	DNT	--	--	3149	85.3	77.2
	12261	5610	63.2	58.5	3032	81.4	68.8
Mattress PU foam wrapped in CA TB 117 cotton sheet – 100 × 150 × 200 mm foam	01232	DNT	--	--	3530	83.2	77.5
Mattress PU foam wrapped in CA TB 117 cotton sheet – 125 × 125 × 300 mm foam	01241	DNT	--	--	4207	88.5	80.5
Mattress PU foam wrapped in polyester microfiber sheet – 125 × 125 × 300 mm foam	01233	DNT	--	--	5353	83.5	79.8
	01245	DNT	--	--	4128	90.2	73.6
Nylon carpet – 150 × 150 mm sample	12262	DNT	--	--	5727	84.4	84.3
Polystyrene pellets – 69.8 g	12272	DNT	--	--	5546	82.6	74.3

Note to Table 25:
DNT = Did not trigger

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

UL 217 Ponderosa pine	12126	3244	63.9	71.1	3226	63.9	72.0
	12132	DNT	--	--	3318	73.4	76.4
	12143	3826	66.0	74.3	3805	68.2	75.0
	12184	3547	66.0	70.1	3451	71.6	75.9
	12185	2894	64.6	73.6	2722	72.3	79.1
Bread – 4 slices	12133	319	66.1	98.0	364	45.9	55.5
	12155	306	71.5	99.4	371	41.5	45.8
	01244	343	75.8	98.5	448	28.4	19.4

Ion Did Not Respond In 1 Out Of 5 UL 217 Tests – 20% Failure Rate

This Is The Test and Material Alarms Are Required to Pass to Be Sold in the US!

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Polyisocyanurate insulation – 150 × 150 × 200 mm pieces	12271	DNT	--	--	DNT	--	--
Mattress PU foam – 150 × 150 × 50 mm foam	12192	DNT	--	--	DNT	--	--
	12193	DNT	--	--	DNT	--	--

Neither Alarm Responded

Per Table Notes Sample Size Too Small to Generate Enough Smoke

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Mattress PU foam – 100 × 125 × 100 mm foam with a 25 × 150 × 150 mm piece on two opposing sides	12202	DNT	--	--	3149	85.3	77.2
	12261	5610	63.2	58.5	3032	81.4	68.8
Mattress PU foam wrapped in CA TB 117 cotton sheet – 100 × 150 × 200 mm foam	01232	DNT	--	--	3530	83.2	77.5
Mattress PU foam wrapped in CA TB 117 cotton sheet – 125 × 125 × 300 mm foam	01241	DNT	--	--	4207	88.5	80.5
Mattress PU foam wrapped in polyester microfiber sheet – 125 × 125 × 300 mm foam	01233	DNT	--	--	5353	83.5	79.8
	01245	DNT	--	--	4128	90.2	73.6
Nylon carpet – 150 × 150 mm sample	12262	DNT	--	--	5727	84.4	84.3
Polystyrene pellets – 69.8 g	12272	DNT	--	--	5546	82.6	74.5

DNT = Did NOT Trigger **Ion's Did Not Trigger in 7 of 8 Tests**

Test 12261: Time = 5610 at 10.57% Obs / Tripped 43 Mins After Photo

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***CPSC Nuisance Trip Study***
Year:	*2010*
Used Synthetic Material:	*N/A - Cooking in Real Homes*
Duration of Smoldering Test:	*N/A*

Comments: Limited Test – 9 Home Test
8 Homes for 30 Days
1 Home for 60 Days
Combination Ion/Photo Twice as Likely to Nuisance Trip at 5 Feet Than Either Ion/Photo Only

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Test/Study:

Agency:	***NIST - TN1837***
Year:	*2014*
Used Synthetic Material:	*Yes*
Duration of Smoldering Test:	*N/A*

Comments: Tested multiple egress scenarios using flaming and smoldering fires to calculate required sate egress times.

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Table 10. Matched pairs of flaming and smoldering fire performance criteria where the average success rate is nominally equal for smoke obscuration target values on the same row.

Flaming fire test alarm criterion		Smoldering fire test alarm criterion	
Smoke Obscuration (%/ft obsc.)	Averaged success rate and standard deviation (%/%)	Smoke Obscuration (%/ft obsc.)	Averaged success rate and standard deviation (%/%)
2*	94.3/5.7	**12***	93.0/4.4
4	86.0/11.4	**14**	86.0/11.6
5	79.0/14.1	**16**	80.8/16.5
6	71.8/17.0	**20**	69.0/19.7
8	59.8/19.1	**22**	58.8/20.0
10**	49.0/19.1	**24****	45.3/21.7

* Matched performance achievable with combination photoelectric/ionization alarm
**Current standalone photoelectric and ionization alarms would most likely pass with these criteria [4].

NIST TN 1837:

Remember, did not factor in alarm functionality due to nuisance alarms

Source: NIST – 1837, Table 10

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Letter From CPSC to UL STP 217 Regarding NIST TN1837, Nov. 18, 2014:

CPSC staff is concerned that the Standards Technical Panel failed to reach consensus on the first proposal (July 2014) through the voluntary standard process for the flaming and smoldering polyurethane foam tests. Consequently, *CPSC staff is hopeful that the STP will reach consensus on the second attempt to adopt the flaming and smoldering polyurethane foam tests for smoke alarms and neither is rejected.*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Letter From CPSC to UL STP 217 Regarding NIST 1837, Nov. 18, 2014:

CPSC staff is aware of incidents where functional residential smoke alarms did not activate in sufficient amount of time for both flaming and smoldering fires to allow occupants to escape the home.

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Letter From CPSC to UL STP 217 Regarding NIST 1837, Nov. 18, 2014:

The present UL proposal is for an alarm threshold of 7%/ft obscuration for the flaming polyurethane test and a 12 %/ft obscuration limit for the smoldering polyurethane test. According to Table 10, this corresponds to between 60 to 72 percent average occupant successful escape rate and 93 percent average occupant successful escape rate, respectively.

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Letter From CPSC to UL STP 217 Regarding NIST 1837, Nov. 18, 2014:

*This proposed test criterion would foster a marked performance improvement over today's typical single sensor smoke alarms, which **have a 45 to 49 percent average occupant successful escape** rate for selected fires, more so for the smoldering fires than flaming fires.*

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Letter From CPSC to UL STP 217 Regarding NIST 1837, Nov. 18, 2014:

The proposals should incorporate obscuration thresholds that *improve the performance of smoke alarms* for both flaming polyurethane and smoldering polyurethane fires, thus allowing occupants a successful escape rate of at least 80 percent.

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Deadly Differences
Ionization vs Photoelectric Smoke Alarms

Other Issues Impacting Safe Egress Times

CodeCheck

Deadly Differences
Ionization vs Photoelectric Smoke Alarms

The Use of Modern Engineered Wood and Synthetic Materials Have Reduced Escape Times:

Engineered Wood Framing Burns to Structural Failure Significantly Faster Than Dimensional Lumber

Source: Fire Engineering Magazine, Toomey, May 2008

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Floor Collapse In as Little as 6 Minutes.

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

The Use of Modern Engineered Wood and Synthetic Materials Have Reduced Escape Times:

The Time From Ignition to Flashover Has Fallen Significantly Due Primarily to Modern Synthetic and Composite Wood Materials

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

"Both rooms were ignited by placing a lit stick candle on the right side of the sofa. The fires were allowed to grow until flashover. The legacy room transitioned to flashover in 29 minutes and 30 seconds whereas the modern room transitioned in just 3 minutes and 30 seconds."

Source: Smoke Alarms and the Modern Residence Fire – UP May 2011

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

*"The National Institute of Standards and Technology (NIST) compared escape times from house fires before and after the increase of synthetic materials in home furnishings. The study found that escape time in 1975 averaged 17 minutes. By 2003, that average had dropped to just **three minutes**."*

Source: ICC Residential Fire Sprinkler Systems book

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Examples of Real Word Fires:

Hilton Hotel Fire, Houston 1982

Room Fire, Room Had Ion Alarm

First Alarm to Operate was a Photoelectric Alarm 4 Floors Above in a Corridor

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Examples of Real Word Fires:
Prudential Building Fire, Boston 1986

Fire on Floor 14 of 52

Alarms Were Ion's at Each Elevator Lobby

Most Alarms on Upper Floors Never Activated During 2 1/2 Hour Event – Even Though Smoke Reached Them Within 4 Minutes

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Examples of Real Word Fires:

Andrea Dennis, Kyle Raulin, Al Schlessman, Erin DeMarco, and Christine Wilson These five students died at Ohio State University on April 13, 2003

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Examples of Real Word Fires:

Julie Turnbull, Kate Welling & Steve Smith died in this house on April 10th, 2005 at Miami University

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Examples of Real Word Fires:

Between the Dennis, Ohio State and Turnbull Miami University ***there were an estimated 22 smoke alarms installed.***

All Were Ionization Alarms. Most Were Believed Functional. Some Had Been Disabled.

Only A Few Sounded, But Went Off Too Late

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Dean Dennis:

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Boston…

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

- ***Mid-1990's, Maryland/Massachusetts Had Similar Fire Death Rates***
  - ***Both Slightly Above the National Average***
- ***Fire Death Rate Twenty Years Later:***
  - ***Maryland: At National Average***
  - ***Massachusetts: 40% Below National Average***

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Most Current Fire Death Rate Data:

Maryland Fire Death Rate: 9.8

Massachusetts Fire Death Rate: 5.4

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

- ***Boston Enacted Photoelectric Technology Ordinance In 1997***
- ***Homes Built/Renovated After 1997 – Require Photo Alarms***
- ***Most FD Alarm Giveaway's – Photo Only***
- ***It Is Estimated 70% of SA Sales Are Photo in Boston Area***
- ***Boston: One of the Lowest Fire Death Rate of a Major Metro Area***
- ***When Residential Fire Fatalities Occur, About 90% Are In ION ONLY Homes***

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

Boston FD 2011-2015 Study:

	Ion Fatalities	Photo Fatalities	Ion Percent
2011	***14***	*3*	***82%***
2012	***17***	*1*	***94%***
2013-2015	***53***	*6*	***89%***

Source: Boston Fire Department

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

- *Majority of Residential Alarms Photoelectric*
- *Most Photo Deaths Related to Other Factors*
  - *Intimate, Impaired, Etc.*
- *Many Hardwired Ion Alarms Disabled*
- *NO Photoelectric Alarms Disabled*
  - *Regardless of Battery Only or Hardwired*

Source: Boston Fire Department

CodeCheck

Deadly Differences

Ionization vs Photoelectric Smoke Alarms

June 12, 2008
Chairman Nancy Nord
US Consumer Product Safety Commission
4330 East-West Highway
Room 419
Bethesda, MD 20814

Dear Chairman Nord:

I am writing as a follow-up to a letter sent to the Consumer Product Safety Commission (CPSC) by Deputy Fire Chief Joseph Fleming of the Boston Fire Department on March 12, 2008 regarding the safety of smoke alarms. It is my understanding that there are multiple unresolved issues concerning ionization detectors' inability to detect smoke or sound an alarm. In fact, it is my understanding that the CPSC expressed serious concerns regarding ionization detectors as early as 1995. These concerns mirror those put forward by Chief Fleming, an outspoken advocate for removing ionization detectors from the marketplace. Yet, the CPSC still has not acted to remove the alarms from the market, nor has the CPSC warned consumers as to the potential drawbacks of ionized detectors.

The issues that appear to be the most prescient and that were addressed by Mr. Fleming in his letter to you, still remain unsettled. I ask that you address, the questions in Chief Fleming's letter in detail, and respond to the following concerns:

1. The National Institute for Standards and Technology (NIST) has found that, on average, a photoelectric detector is 30 minutes faster in detecting a smoldering fire than an ionized detector. The highest percentage of deaths caused by smoldering fires occurs while people are sleeping, when the operation of a smoke detector is critical. In fact, this percentage may be as high as 100 percent. Four years ago NIST reached the conclusion that ionization detectors sometimes fail to alarm in smoldering fires, even when visibility is significantly degraded by smoke.

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2. While ionized detectors alarm sooner in "ultra-fast" flaming fires by an average of 50 seconds, those seconds appear to be negligible considering that most people are awake when flaming fires occur. In addition, in what appears to be the most common type of flaming fires (i.e. cooking fires) the photoelectric detector was providing more than enough time for an occupant to escape.

3. Several studies show that the ionization smoke detector is many times more likely to be disabled than photoelectric detectors.

4. The ionization smoke detector is being used by the vast majority of Americans. The ionization smoke alarms susceptibility to nuisance alarms (leading to disablement) and inadequate response to smoldering fires could be responsible for hundreds of needless deaths each year.

Recently, due to the efforts of Chief Fleming of the Boston Fire Department to educate the authorities to these facts, the states of Massachusetts and Vermont have taken steps to restrict the use of ionization smoke detectors in residential occupancies. In response to the available evidence that suggests the inherent danger of ionization detectors, I ask that you promptly investigate the issues raised by Chief Fleming, and that you respond to his letter of March 12, 2008.

Fire safety and the use of working fire alarms are vital to the protection of our children, seniors, adults and families around the United States. I strongly urge you to provide a timely response to the above concerns and to consider the potential loss of life should it become clear that a large percentage of Americans are using inadequate smoke detectors.

I appreciate your attention to this matter. Please feel free to contact me if you have any questions.

Sincerely,

John F. Kerry

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Maybe you still don't believe me, here is the NIST Statement for the Record at a Boston Public Safety Hearings in August 2007:

*"However, **ionization detectors** have been shown to sometimes **fail to alarm in a smoldering fire even when visibility in the room is significantly degraded** by smoke. Most photoelectric detectors alarm substantially sooner in these situations.*

*In the NIST experiments the photoelectric detectors sensed smoldering fires **on average 30 minutes** earlier than the ionization detectors."*

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Adrian Butler is a Former Fire Fighter
He Started a Smoke Alarm Manufacturing Company
Adrian Noticed That He Was Receiving a Number of Complaints About His Alarms Not Going Off in Fires...
So He Started Digging

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What He Found Made Him Get Out of the Smoke Alarm Business
and
Co-Found the World Fire Safety Foundation

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Canadian Television – Channel 5 Report Excerpts Including

Texas A& M Video

Note: Canadian UL (ULC) Standards Are More Strict Than US Standards
Canada = Max OB Level 6% / US = Max OB Level 10%

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ABC Interview: BRK/First Alert Executive

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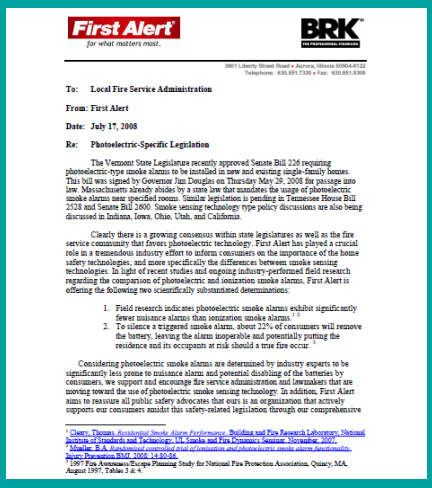
BRK/First Alert Letter to Vermont Fire Dept's



First Alert
for what matters most.

BRK

3901 Liberty Street Road • Aurora, Illinois 60504-8122
Telephone: 630.851.7330 • Fax: 630.851.1309

To: Local Fire Service Administration

From: First Alert

Date: July 17, 2008

Re: Photoelectric-Specific Legislation

The Vermont State Legislature recently approved Senate Bill 226 requiring photoelectric-type smoke alarms to be installed in new and existing single-family homes. This bill was signed by Governor Jim Douglas on Thursday May 29, 2008 for passage into law. Massachusetts already abides by a state law that mandates the usage of photoelectric smoke alarms near specified rooms. Similar legislation is pending in Tennessee House Bill 2538 and Senate Bill 2600. Smoke sensing technology type policy discussions are also being discussed in Indiana, Iowa, Ohio, Utah, and California.

Clearly there is a growing consensus within state legislatures as well as the fire service community that favors photoelectric technology. First Alert has played a crucial role in a tremendous industry effort to inform consumers on the importance of the home safety technologies, and more specifically the differences between smoke sensing technologies. In light of recent studies and ongoing industry-performed field research regarding the comparison of photoelectric and ionization smoke alarms, First Alert is offering the following two scientifically substantiated determinations:

1. Field research indicates photoelectric smoke alarms exhibit significantly fewer nuisance alarms than ionization smoke alarms.[1] [2]
2. To silence a triggered smoke alarm, about 22% of consumers will remove the battery, leaving the alarm inoperable and potentially putting the residence and its occupants at risk should a true fire occur. [3]

Considering photoelectric smoke alarms are determined by industry experts to be significantly less prone to nuisance alarm and potential disabling of the batteries by consumers, we support and encourage fire service administration and lawmakers that are moving toward the use of photoelectric smoke sensing technology. In addition, First Alert aims to reassure all public safety advocates that ours is an organization that actively supports our consumers amidst this safety-related legislation through our comprehensive

[1] Cleary, Thomas, *Residential Smoke Alarm Performance*, Building and Fire Research Laboratory, National Institute of Standards and Technology; M. Combs and Fire Dynamics Seminar, November, 2000.
[2] Mueller, B.A. *Randomized controlled trial of ionization and photoelectric smoke alarm functionality*. Injury Prevention 2002; 14:80-84.
[3] 1997 Fire Awareness/Escape Planning Study for National Fire Protection Association, Quincy, MA, August 1997, Tables 3 & 4.

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Deadly Differences

Ionization vs Photoelectric Smoke Alarms

BRK/First Alert Letter to Vermont Fire Dept's

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What Is Being Done?

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In the US, Photoelectric Technology Laws In Place In:

Massachusetts
Vermont
Ohio
Maine
Rhode Island
Iowa

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- *NY City Ordinance INT-56A*
  - *Requires At Least One Photo Per Residential Unit*
  - *Has 40 Sponsoring Councilmembers – Almost Veto Proof*
  - *Supported By FDNY*
  - *Vote Is Believed Imminent*
  - *I Testified On Behalf of ASHI & CREIA*

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Averyana's Law, New York

Aunt Valerie Rivett, Averyana Dale, Natalie her Godmother and sister Gia

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Averyana's Law

Currently there are two types of smoke detectors available in the market place, Ionization and Photoelectric. **Ionization detectors are present in about 95% of homes. Unfortunately these types of detectors have a high rate of failure** when detecting smoldering fires. **Photoelectric detectors on the other hand, are extremely successful** at detecting smoldering fires.

Averyana Dale most likely lost her life because the ionization smoke detector that was present in the home she was in did not alert her to the fire until it was too late. If a photoelectric detector had been in the home, it is considerably more likely she would have been alerted to the smoke sooner and would have made it out safely.

This legislation is meant to provide an incentive for homeowners to purchase photoelectric detectors. These detectors will save lives by adding an extra layer of protection for anyone who may experience a fire.

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Ionization vs Photoelectric Smoke Alarms

Averyana's Law, New York

My niece, Averyana Dale was only two when she and her godmother died in a smoldering fire. At the time, I was confused because the apartment had smoke alarms. I wanted and needed answers. Like most, I thought a smoke alarm was a smoke alarm. I now know that is not the case. I am convinced that if Averyana and her godmother had been protected by photoelectric alarms, they would both be alive today. Unfortunately, every day 3 more people suffer the same fate .

I have been working with NY State Senator Nozzolio and Assemblyman Finch, Averyana's Law is currently pending in New York. There is nothing I can do to bring Averyana or her godmother back. But I can help make sure that these senseless deaths stop.

Tonight, 2-3 more people will die needlessly. The difference is that now you will know why. You and all the other ASHI Inspectors can make a difference. Help me make sure Averyana did not die in vain.

-Valerie Rivett

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Ionization vs Photoelectric Smoke Alarms

In the Ohio, Photoelectric Technology Ordinances Are In Place In:

Cincinnati

Shaker Heights

Chagrin Falls

Several Other Cities

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Pro-Photo:
North Eastern Ohio Fire Chief's Organization
"Photoelectric Smoke Alarms Save Lives" Campaign

See www.PhotoeletricSaves.com

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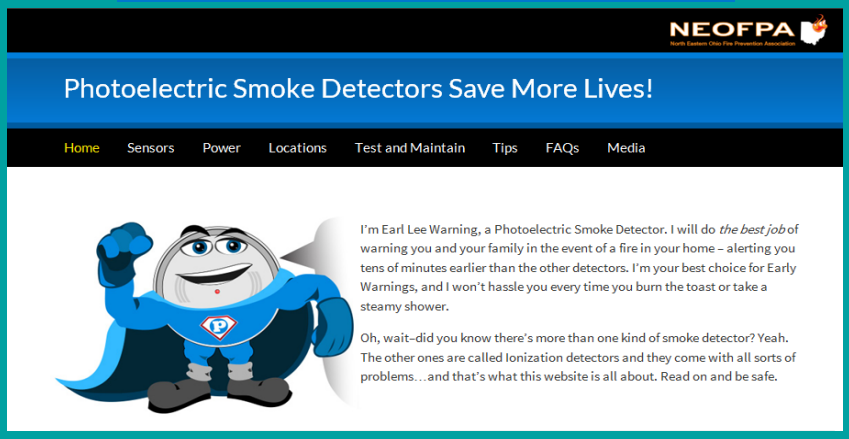
www.PhotoeletricSaves.com



Meet Earl Lee Warning!

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Ionization vs Photoelectric Smoke Alarms

International Association of Fire Fighters:

IAFF Official Position Calling for

Photoelectric *Only Technology*

Specifically States, No Combination Detectors

Union Represents Around 300,000 US & Canadian Fire Fighters

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Ionization vs Photoelectric Smoke Alarms

In the CA, Photoelectric Technology Ordinances Are In Place In:

Palo Alto
City of Albany
Sebastopol
City of Orange

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Deadly Differences
Ionization vs Photoelectric Smoke Alarms

California Real Estate Inspection Association

Official Position Calling for Photoelectric Only Technology
Specifically States, No Combination Detectors

Mirrors IAFF Position, First HI Organization in The World to Take a Stand

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Ionization vs Photoelectric Smoke Alarms

American Society of Home Inspectors

Board Adopted Position Promoting Photoelectric Technology in 2013

ASHI is First National HI Organization in The World to Take a Stand

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Ionization vs Photoelectric Smoke Alarms

ASHI Standards of Practice States:
Inspector is Not Required to Determine Type of Alarm

CREIA Standards of Practice States:
Inspector is Not Required to Determine Type of Alarm
CREIA Legal Counsel Felt No Additional Liability with Position

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Queensland, Australia

- *Sept. 2016: Passes Photo Only Law*
- *Smoke Alarms in Bedroom and Halls, One Per Level*
- *Photoelectric Only, No Combination, No Ion Sensors Allowed*
- *Jan 1, 2017: New Construction, Some SF & Rentals, All Replacement Alarms*
- *Jan 1, 2022: All Sold, Leased and Gov Owned*
- *Before Jan 1, 2027: All Existing Regardless of Age*

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Ionization vs Photoelectric Smoke Alarms

<u>What Can We Do as Inspectors?</u>

Tell Your Agents...Your Clients...

Your Family...Neighbors...Friends, Etc!

<u>What Can ASHI Do?</u>

As a group, make public awareness a Priority

Support State Local Initiatives

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Ionization vs Photoelectric Smoke Alarms

What Do I Say on Inspections?

- *Any Alarms Installed Meet Legal Requirement*
- *95% of Homes Have Ion's*
- *Type NOT Verified*
- *Change All Alarms to Photo/Doubles Survival Rate*
- *Not A Cost Issue*

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Ionization vs Photoelectric Smoke Alarms

RECOMMENDED SAFETY UPGRADE: I recommended that ALL ionization alarms - regardless of age - be replaced with photoelectric smoke alarms. Extensive research clearly shows that photoelectric smoke alarms are far more reliable in most real-world fire scenarios. Nearly 95% of the smoke alarms installed in US residences are IONIZATION alarms. Ionization alarms are approved smoke alarms and DO comply with the legal requirements for transfer in MOST jurisdictions. However, significant research shows that ionization alarms RESPOND TOO SLOWLY to the smoldering/smoke fires responsible for most residential fire deaths. Ionization alarms are also notorious for nuisance tripping from cooking, shower steam, etc. Ionization alarms will fail to adequately warn occupants about 55% of the time. With photoelectric alarms the occupants will receive sufficient warning about 96% of the time. Ionization technology alarms pose a significant life-safety risk. Combination alarms are not recommended. The type of alarm installed was not verified as part of this inspection. Interested parties should consult with a qualified trade specialist for service.

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Ionization vs Photoelectric Smoke Alarms

In Closing.....

- *All Fires Do Not Carry The Same Risk Of Death*
- *Two-Thirds of Fire Deaths Occur in Homes With No Functional Alarms*
- *Half of Non-Functional Alarms Are Attributed to Nuisance Trips*
- *Almost All Nuisance Trips are From Ionization Alarms*
- *Of the Remaining One-Third – Only 15% Are Attributed to Flames*
- *There Has Never Been A Wrongful Death Suit Involving Photoelectric Alarms but Many with Ionization Alarms*
- *Changing to Photoelectric Alarms Would Drop US Fire Death Rate 40% Overnight*

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Ionization vs Photoelectric Smoke Alarms

Questions

And

Comments!

skip@codecheck.com