



# RESEARCH FOUNDATION

## RESEARCH FOR THE NFPA MISSION

### **Workshop for Survey on Usage and Functionality of Smoke Alarms and CO Alarms in Households** **16 February 2017**

**Location:** Consumer Product Safety Commission  
4330 East West Hwy #400  
Bethesda, MD 20814

### **Workshop Agenda** Last Updated: 14 February 2017

**Workshop Hosts:** Arthur Lee, CPSC; Matthew Brookman, CPSC

**Workshop Facilitator:** Amanda Kimball, Fire Protection Research Foundation

**Purpose:** To gather feedback on a planned in-home survey of households in the US to assess the use and functionality of smoke alarms and carbon monoxide alarms.

**Desired outcome:** A list of key areas to inform the smoke alarm and CO alarm survey design.

#### **Background:**

During a Vision 20/20 workshop on smoke alarms in March 2015, conducting a national census (or representative in-home survey) on the prevalence and characteristics of smoke alarms was identified as the top action item among the fifty-nine stakeholder participants. Previous work on this topic includes a national survey conducted by the Consumer Product Safety Commission (CPSC) in the early 1990s, which gathered field data through around 1,000 in-person interviews on the numbers and types of smoke alarms installed in homes, the ways in which they fail, factors leading to non-working alarms, and types of households more likely to have non-working smoke alarms.

There was agreement that while this data set has proven useful, that there is a need to update this information with new data on the use and functionality of smoke alarms in homes across the US. In addition, there is very little data related to the use and functionality of carbon monoxide alarms in homes. To fill the data gaps, CPSC is moving forward with an in-home representative survey across the US to assess the use and functionality of smoke alarms and carbon monoxide alarms.

The purpose of this workshop is to gather feedback from stakeholder groups for this planned survey. Stakeholder groups include the fire service, enforcers/AHJs, public educators, researchers, equipment manufacturers, standards developers, and others. The feedback gathered will help inform the questions and methodology of the survey as well as how it is communicated (i.e. what are the really important pieces of data that need to be gathered and included in the overall data set).

The first part of the day will include a review of previous work, on-going relevant work, data gaps, human behavior changes/societal changes that influence safety behaviors, perception of CO alarms, and changes in smoke alarm listing and installation standards. Then, the workshop participants will be broken into smaller groups to discuss the key areas and topics that they feel are needed as part of the survey.

**Agenda:**

8:15am	<b>Welcome and Purpose</b> CPSC Survey Status – Contract Goals, Process, Outcome Roles – Participants, Hosts, Facilitators Outcomes and Agenda Ground Rules	Amanda Kimball, Fire Protection Research Foundation
8:30am	<b>Summary of the CPSC 1992 Smoke Detector Operability Survey</b>	Steven Hanway, Director, Division of Hazard Analysis, EPHA, CPSC
9:00am	<b>Recent Changes to Codes and Standards:</b> Recent Changes to UL 217, <i>Standard for Smoke Alarms</i> , and UL 2034, <i>Standard for Single and Multiple Station Carbon Monoxide Alarms</i>	Dave Mills, UL
9:30am	Update on Chapter 29 of NFPA 72, <i>Fire Alarm and Signaling Code</i> , and NFPA 720, <i>Standard for the Installation of Carbon Monoxide(CO) Detection and Warning Equipment</i>	L.J. Dallaire, US Architect of the Capital Jason Sutula, Jensen Hughes
10:00am	<b>Break</b>	
10:15am	<b>What Human Behavior Changes and Societal Changes Over the Past 20 Years Influence Safety</b>	Andrea Vastis, MPH, Deliberate Health Solutions
10:45am	<b>Consumer Smoke Alarm Messaging</b>	Peter Mitchell, Salter Mitchell
11:15am	<b>Consumer Perception of CO Alarms</b>	Scott Damon, CDC
11:45am	<b>Data Gaps on Smoke Alarm and CO Alarm Use in Homes</b>	Marty Ahrens, NFPA
12:15pm	<b>Lunch (on your own)</b>	
1:30pm	<b>Draft Protocol for an In-home Survey of Smoke Alarms and CO Alarms</b>	Phil Schaenman, TriData
2:00pm	<b>Overview of the Break Out Groups and Process</b>  Overview of Baseline Survey Questions	Amanda Kimball, Research Foundation  CPSC/Eureka Facts

2:20pm	<b>First Break Out Group Discussion: Brainstorming</b> <ul style="list-style-type: none"> <li>• Questions provided in Attachment A</li> </ul>	All Participants
3:05pm	<b>Break</b>	
3:15pm	<b>Second Break Out Group Discussion: Prioritization</b> <ul style="list-style-type: none"> <li>• Prioritize the information pieces developed in the first break out group discussion</li> <li>• Identify the top five pieces of information that the group feels is needed from the survey</li> </ul>	All Participants
4:15pm	<b>Reports from the Break Out Groups</b>	Break Out Group Leaders/Recorders
5:00pm	<b>Wrap Up and Summary</b>	Amanda Kimball, Research Foundation

## **Attachment A: Break Out Group Questions**

### **Group 1 (prevention with focus on smoke alarms):**

- What information would be useful for prevention activities (including education) related to smoke alarms (e.g. placement of alarms, testing behaviors/maintenance, knowledge of alarm functionality, understanding of hazards, which populations are most at risk, etc.)?
- What occupant related behaviors or perceptions are important to include in the survey (e.g. do they know if they have alarms installed, do they know testing requirements, do they know if their alarms are working, why are there no alarms installed or why are they not working, current alarm testing behaviors, other alarm maintenance activities, how do users interpret chirping, history of fires, are occupants at risk, etc.)?
- What data is needed to with respect to understanding hazard awareness related to smoke (e.g. understanding and adhering to jurisdictional requirements, understanding what hazards are present in the home, behavior patterns associated with smoke alarm placement, behavior upon alarm activation, perceived necessity for devices, etc.)?

### **Group 2 (prevention with focus on CO alarms):**

- What information would be useful for prevention activities (including education) related to CO alarms (e.g. placement of alarms, testing behaviors/maintenance, knowledge of alarm functionality, understanding of hazards, which populations are most at risk, etc.)?
- What occupant related behaviors or perceptions are important to include in the survey (e.g. do they know if they have alarms installed, do they know testing requirements, do they know if their alarms are working, why are there no alarms installed or why are they not working, current alarm testing behaviors, other alarm maintenance activities, how do users interpret chirping, history of fires, are occupants at risk, etc.)?
- What data is needed to with respect to understanding hazard awareness related to CO (e.g. understanding and adhering to jurisdictional requirements, understanding what hazards are present in the home, behavior patterns associated with CO alarm placement, behavior upon alarm activation, perceived necessity for devices, etc.)?

### **Group 3 (codes and standards):**

- What information would be useful for code/standard activities (e.g. types and placement of alarms, age of alarms, power source details, etc.)?
- What data is needed to with respect to understanding hazard awareness (e.g. understanding and adhering to jurisdictional requirements, understanding what hazards are present in the home, behavior patterns associated with smoke alarm placement, behavior upon alarm activation, perceived necessity for devices, etc.)?
- What information about the home is important to know (e.g. type of home, age of home, last renovation, did the respondent install the alarms or were they already installed, etc.)?



**Group 4 (codes and standards):**

- What information would be useful for code/standard activities (e.g. types and placement of alarms, age of alarms, power source details, etc.)?
- What occupant related behaviors or perceptions are important to include in the survey (e.g. do they know if they have alarms installed, do they know testing requirements, do they know if their alarms are working, why are there no alarms installed or why are they not working, current alarm testing behaviors, other alarm maintenance activities, how do users interpret chirping, history of fires, are occupants at risk, etc.)?
- How to replace non-working alarms (have fire department install, hand out alarms, liability issues, what are current practices, etc.)?

**Group 5 (technology with focus on smoke alarms):**

- What information would be useful for design of smoke alarm technology (e.g. type of alarms installed, age of alarms, experience with nuisance alarms, etc.)?
- What occupant related behaviors or perceptions are important to include in the survey (e.g. do they know if they have alarms installed, do they know testing requirements, do they know if their alarms are working, why are there no alarms installed or why are they not working, current alarm testing behaviors, other alarm maintenance activities, how do users interpret chirping, history of fires, are occupants at risk, etc.)?
- How to replace non-working alarms (have fire department install, hand out alarms, liability issues, what are current practices, etc.)?

**Group 6 (technology with focus on CO alarms):**

- What information would be useful for design of CO alarm technology (e.g. type of alarms installed, age of alarms, experience with nuisance alarms, etc.)?
- What data is needed to with respect to understanding hazard awareness related to CO (e.g. understanding and adhering to jurisdictional requirements, understanding what hazards are present in the home, behavior patterns associated with CO alarm placement, behavior upon alarm activation, perceived necessity for devices, etc.)?
- What information about the home is important to know (e.g. type of home, age of home, last renovation, did the respondent install the alarms or were they already installed, etc.)?

# SMOKE DETECTOR OPERABILITY STUDY (1992)



United States  
Consumer Product Safety Commission

*The material contained in this presentation is that of the CPSC staff and has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.*

# WHAT WAS THE 1992 SMOKE DETECTOR OPERABILITY STUDY?

- A joint project between the U.S. Consumer Product Safety Commission, the Congressional Fire Services Institute, the U.S. Fire Administration, and the National Fire Protection Association, with numerous other public and private organizations participating (including the Dept. of Housing and Urban Development).
- The main objective of the study was to determine the operability of smoke detectors in American households.
- In other words, the study went beyond simple self-reports of whether respondents would indicate they had a smoke alarm and whether it was working but had direct observation of the presence and operability of these alarms.



# SAMPLE DESIGN

- Two-stage stratified design with zip codes selected in 30 urban and 10 rural areas.
- Twenty interviews were conducted in each zip code for a total of 800 in the main sample.
- In addition, an oversample of 25 interviews with low income households in 8 clusters (6 urban, 2 rural) that were part of the main sample and had the lowest median income.
- Multi-stage sampling of this kind is necessary to minimize costs however it reduces the effective sample size and increases margins of sampling error.



# COMPLETION RATES

	Total Sample	Main Sample	Oversample
Completion Rate	68%	65%	77%

Completion Rate = (Completes plus not eligible / All attempted residences)






# FINDINGS (MAIN SAMPLE)

	Main <u>Sample</u>
No Detectors in household	12%
One or more detectors	88%
Central system detector(s) (not tested)	5%
non-central detector(s)	83%
One or more working detectors	66%
No working detectors	17%



## FINDINGS (MAIN SAMPLE)

	Main Sample	Operable*	Not Operable
No Detectors in household	12%	--	12%
Central system detector(s)	5%	Not tested	Not tested
One detector	49%	36%	13%
Two detectors	23%	20%	3%
Three detectors	6%	6%	1%
Four or more detectors	4%	4%	<1%
 Total	100%	66%	29%

\*At least one working smoke alarm after smoke and button tests

## FINDINGS (MAIN SAMPLE)

	<u>Operability rate*</u>
Urban	80%
Rural	79%
Apartment/Condo	78%
Single family (town/row)	80%
Detached single family	81%
<u>Mobile/trailer/manufactured</u>	<u>73%</u>
Total main sample	80%

\*At least one working smoke alarm after smoke and button tests among tested households





# FINDINGS (MAIN SAMPLE)

	<u>Operability rate*</u>
Resident thought all detectors work	88%
<u>Low income households</u>	<u>70%</u>
Total main sample	80%

\*At least one working smoke alarm after smoke and button tests among tested households



# QUESTIONS

[https://www.cpsc.gov/s3fs-public/operable.pt1\\_.pdf](https://www.cpsc.gov/s3fs-public/operable.pt1_.pdf)

Stephen Hanway

Director, Division of Hazard Analysis

U.S. Consumer Product Safety Commission

shanway@cpsc.gov



MISSING (FILE WILL BE UPDATED WHEN PRESENTATION IS AVAILABLE)

Recent Changes to UL 217, *Standard for Smoke Alarms*, and UL 2034, *Standard for Single and Multiple Station Carbon Monoxide Alarms*

Dave Mills, UL

# NFPA Research Foundation

Workshop for Survey on Usage and Functionality of Smoke Alarms and CO Alarms  
in Households

Consumer Product Safety Commission

16 February 2016



## **Residential Smoke Alarms: A Discussion of NFPA 72 Location Requirements**

**Laurence J. Dallaire, PE  
Fire Marshal  
Architect of the Capitol**

## Learning Objectives



- Describe NFPA 72.
  - Outline basic spacing requirements for household smoke alarms.
  - Provide a brief history of code changes related to detection.
  - Explain the life cycle of code adoption.
  - ~~Make you an EXPERT in fire alarm design!~~
-

## What Is NFPA 72?



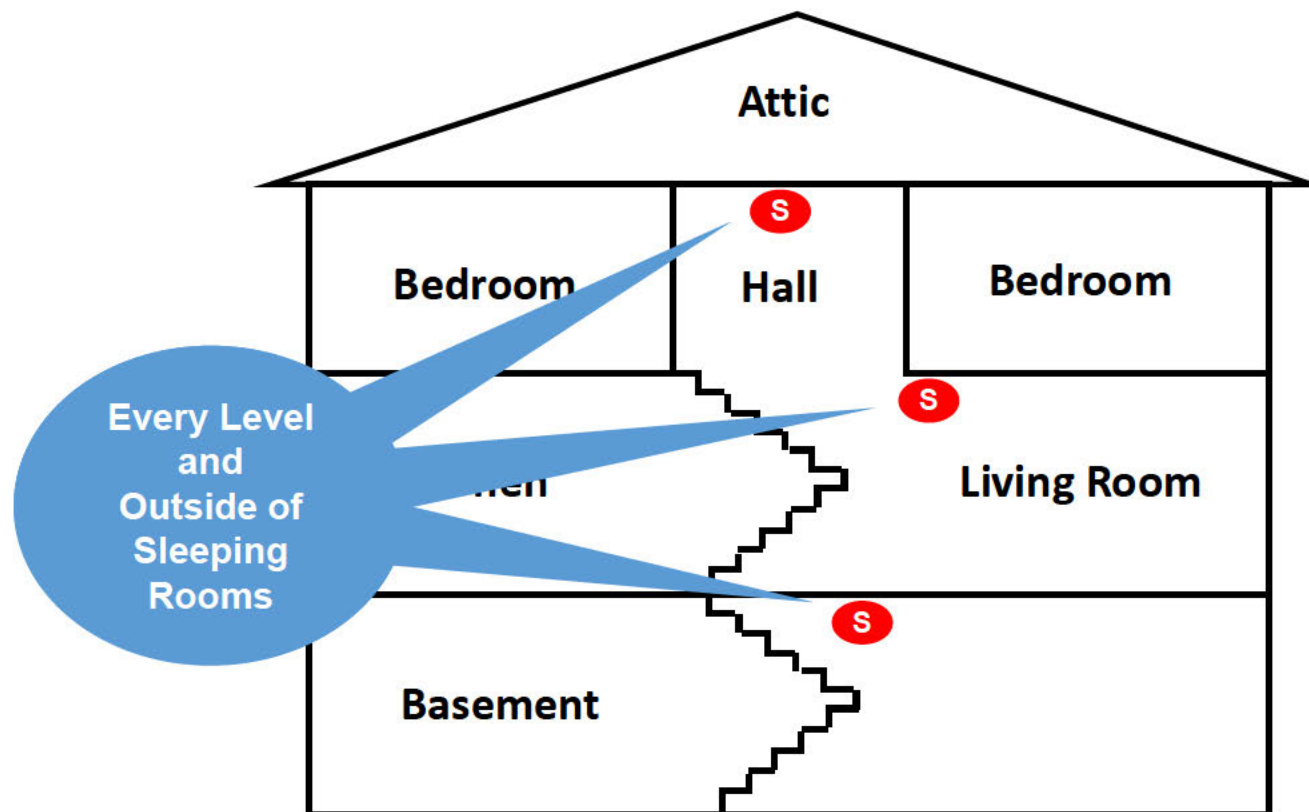
- NFPA 72 is the National Fire Alarm and Signaling Code.
  - It is a model standard to determine what must be included in a fire alarm system.
  - Starting with the 2019 Edition, NFPA 72 contains requirements for Carbon Monoxide alarms (currently in NFPA 720).
  - NFPA 72 applies to residential, commercial and industrial buildings.
  - Chapter 29 has specific requirements that apply to residential occupancies, including apartments, hotels and houses.
-

## Why is NFPA 72 Important?



- NFPA 72 is adopted by reference in the International Building Code and International Residential Code.
  - IBC and IRC are then modified and adopted into state and local law, as well as federal standards.
  - NFPA 72 is the basic underlying document that sets minimum standards for installation of smoke alarms (and CO alarms!) in residences.
-

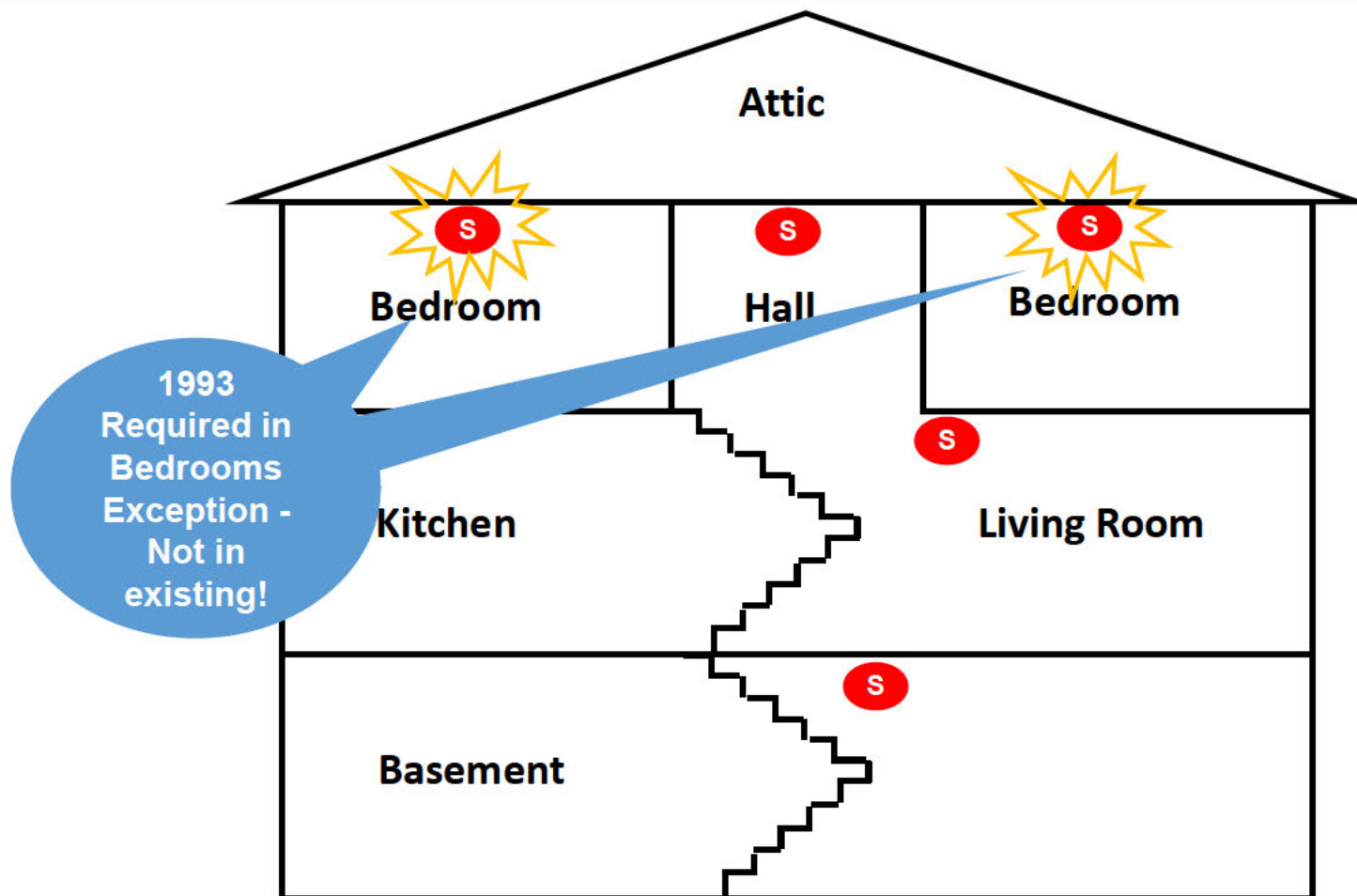
# Pre-1993 Location Requirements



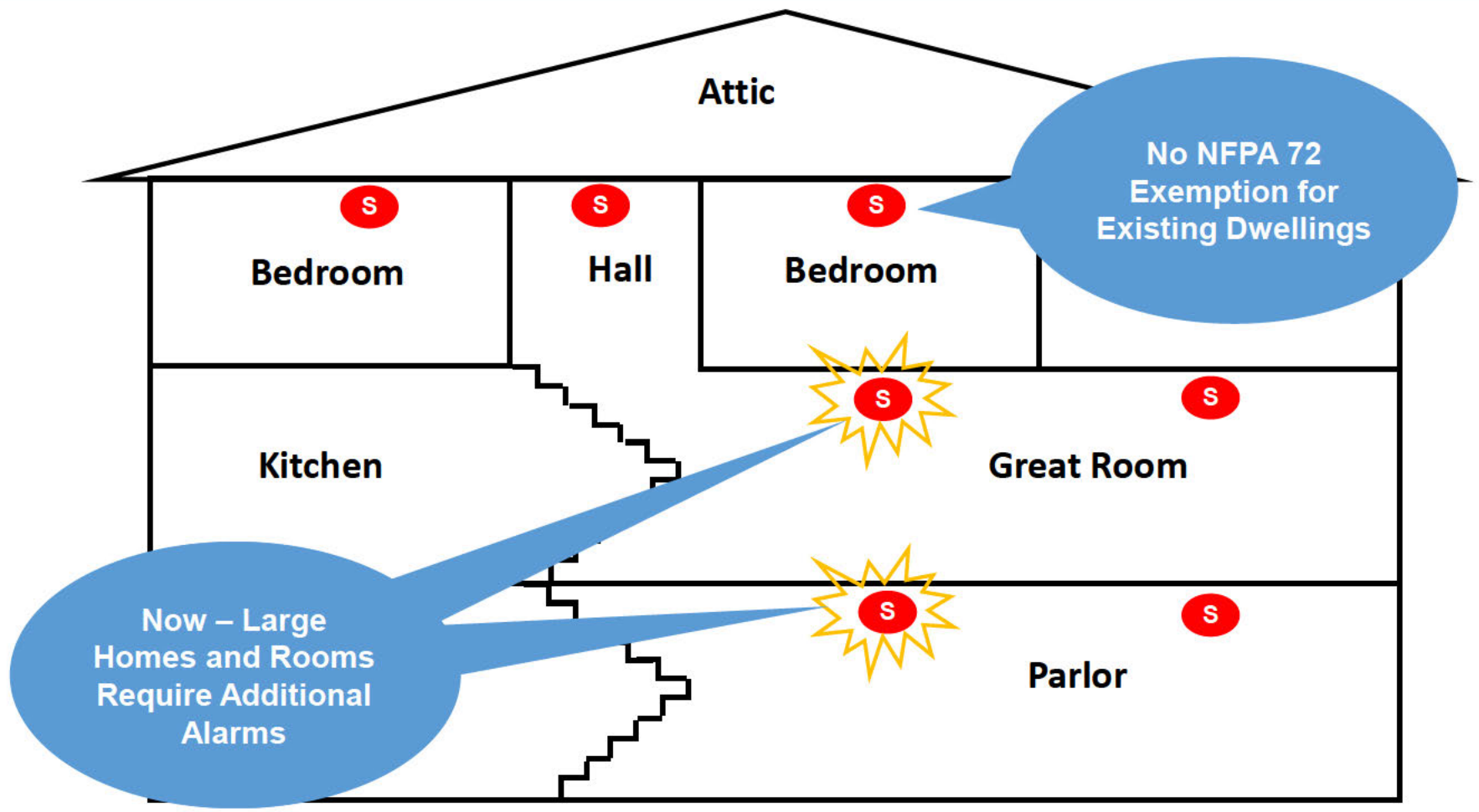
- Outside of Sleeping Rooms and on Every Level



# 1993-2002 Location Requirements



# Current Location Requirements (Since 2007)



## NFPA 72 and Nuisances?



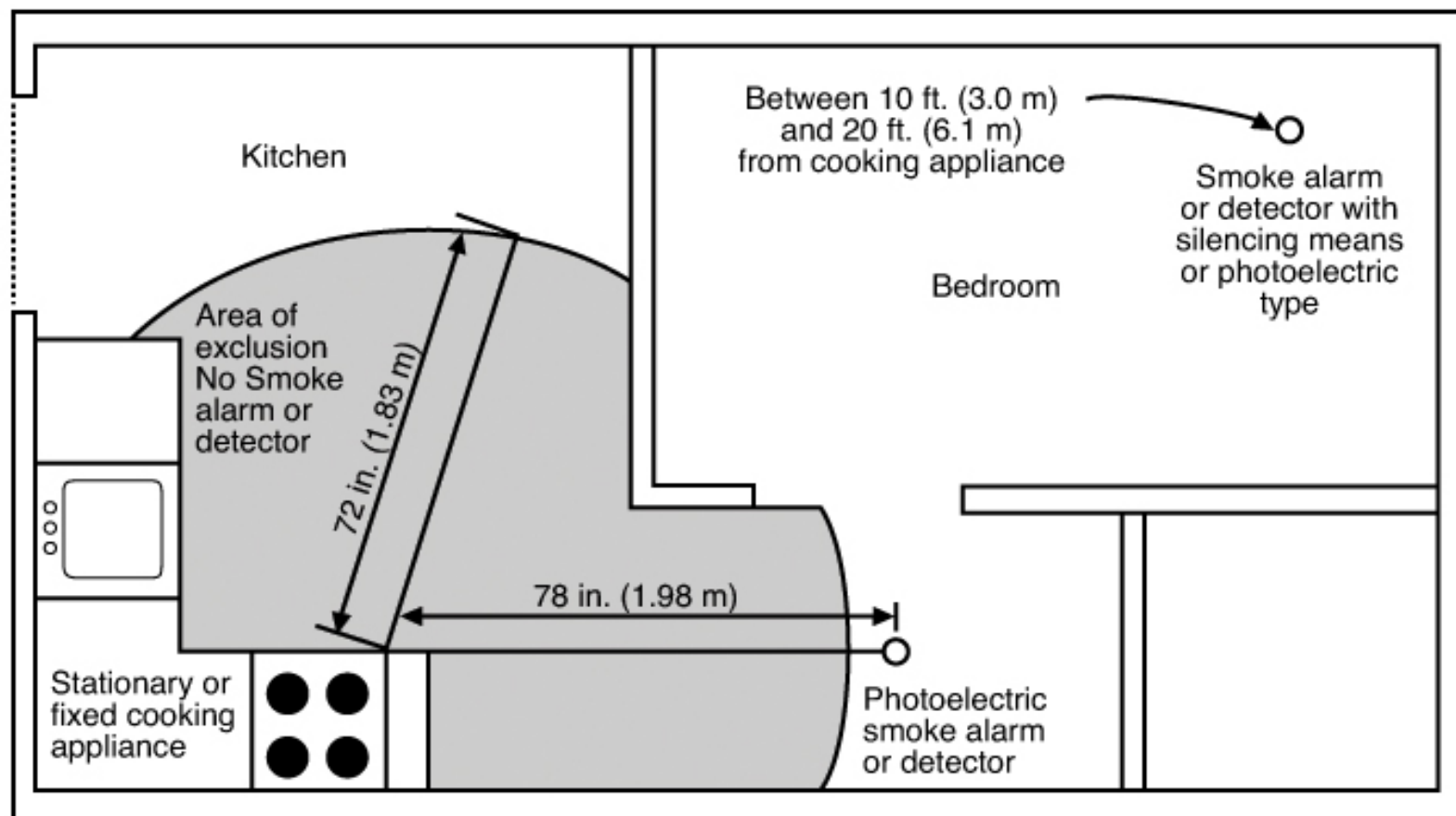
- Section 29.8.3.4 addresses specific locations to reduce nuisances.
    - Alarms are not permitted within 36 inches of bathroom doors containing a shower or tub (steam!).
    - Not required in unfinished attics or garages with temperatures above 100F or below 40F.
    - Not permitted in spaces with incompatible ambient conditions.
-

# Cooking Nuisances



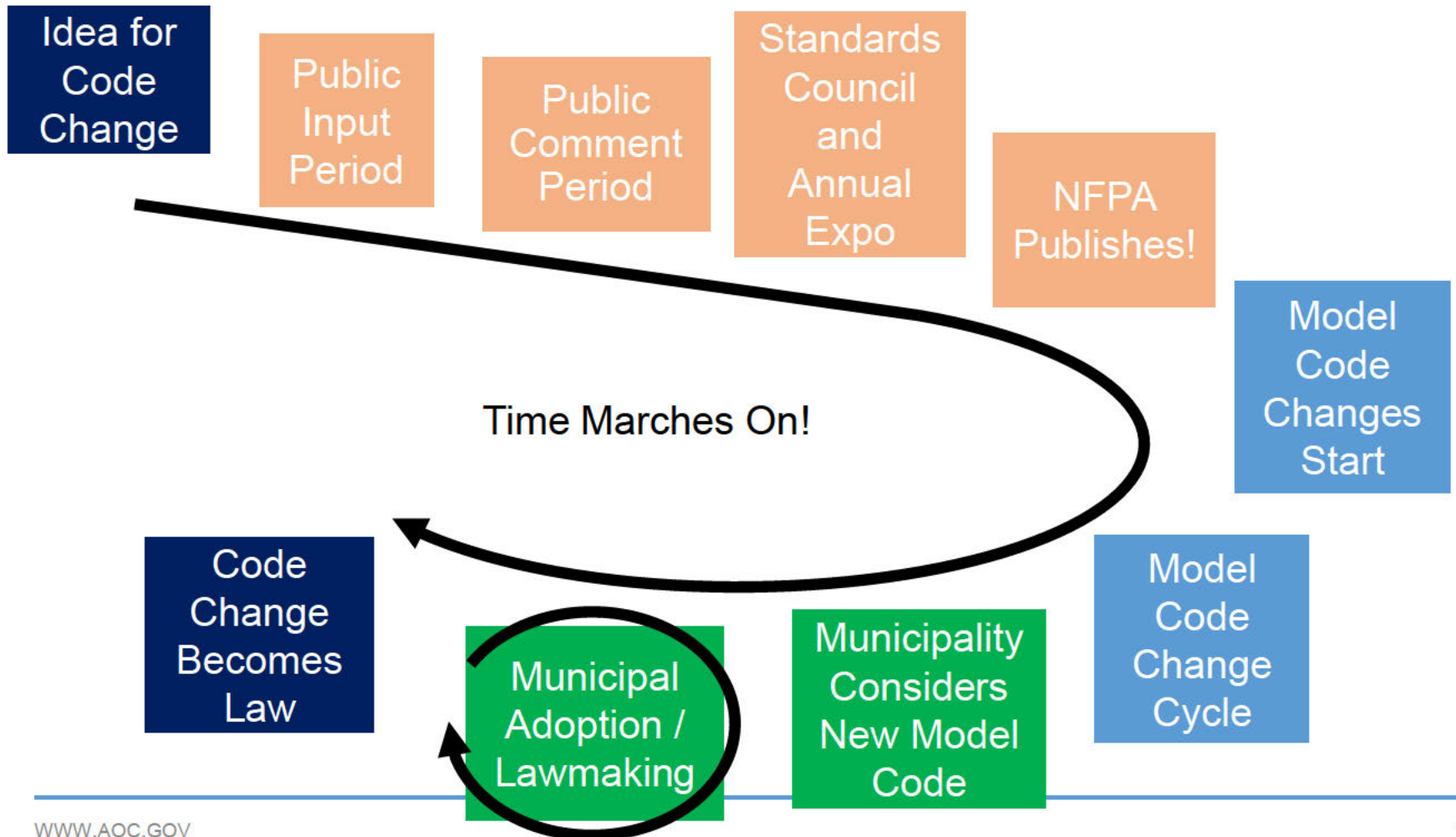
- In addition, cooking nuisances were updated and specifically addressed in 2013.
    - Alarms must be at least 10-ft away from cooking appliance, unless listed for use near the appliance.
    - Alarms between 10-ft and 20-ft from a cooking appliance must have alarm silence or use photoelectric detection.
    - An exception was allowed for small spaces where compliance with standard spacing would preclude installation of an alarm.
    - Alarms using photoelectric detection are permitted between 6 and 10 feet in small spaces.
  - Starting ~~2016~~ ~~2019~~ 2020, smoke alarms within 20-ft of cooking appliances must be listed for cooking nuisance sources.
-

# Nuisance Distances



2013 Kitchen Detector Spacing

# Adoption Time



# Application to New Construction



- 2012 Virginia Construction Code
  - Effective July 2014
  - 2012 International Building Code
  - 2010 National Fire Alarm Code
- A dwelling built TODAY in Virginia is constructed to 2010 NFPA 72.
  - No Kitchen Spacing Requirements
- Houses built in as in late 1990's very likely had no requirement for bedroom smoke alarms.





ARCHITECT  
OF THE CAPITOL



# Understanding Consumer Perception of Risk: Blending Theory & History

Andrea G Vastis, MPH, CHES, Deliberate Health Solutions

February 16, 2017

NFPA/CPSC

AKA: *Why  
won't they just  
do what I tell  
them!??*

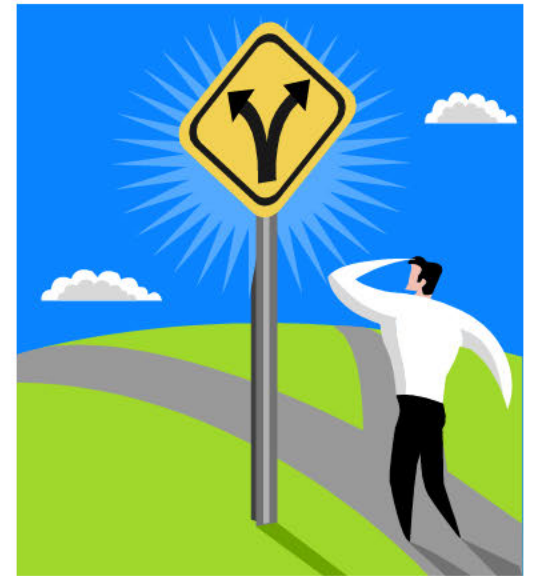


## In this session

- What kinds of things influence our health-related behaviors?
- How has our collective perception of risk changed over time?
- How does our perception of risk impact our choices?

How do you  
judge.....

- ▶ If you are healthy?
- ▶ If you are safe?
- ▶ What is your point of reference for these things?



We engage in  
health-related  
behaviors  
based variety  
of factors



# Behavior is made up of

- Learned actions
- Attitudes
- Beliefs
- Cultural norms
- Economics
- Geography
- Historical Events



How “safe” we  
feel depends  
upon our  
perceptions

- Our physical environment
- Our social environment
- Our “Trust” in the “System”
- Our Locus of Control
- Messages we receive  
(and the messenger!)







**“Good news.  
Your cholesterol has stayed the same,  
but the research findings have changed.”**


Andrea A. Mastis, MPH



# Our sense of the world around us...

- 1950's...Post WWII...Prosperity...Overcome obstacles
  - 1960's... Cold War... Nuclear Threat...Air Raid Drills
  - 1970's...Economic and Gas Crisis...Make love not war
  - 1980's...High interest rates and inflation...Make Money
  - 1990's..."Global Village"...Internet....Alternative Media Outlets
  - 2000's...Violence....Terrorism...Lock Down Drills
- 
- Causes of morbidity and mortality changed from communicable disease to chronic disease
  - Amazing medical/technological advances
  - Immediate reporting of events as they unfold
  - Shift in focus on intentional vs. unintentional injury
  - Push/Pull of regulations to support public safety – common good vs. individual freedoms (helmet & seatbelt laws, etc)

Why do we need to understand our audience's perceptions when we have facts on our side?

- Information  Action
- Who here knows that texting and driving increases your risk of a crash?

The average text takes 4.6 seconds; on the highway, how far have you driven "blind" in those 5 seconds?



4.6 seconds  
with your eyes  
off the road:



- Answer: 300 feet

# Our perception of risk:

We engage in a Cost-Benefit negotiation

## We overestimate

- Our reflexes
- Our driving ability

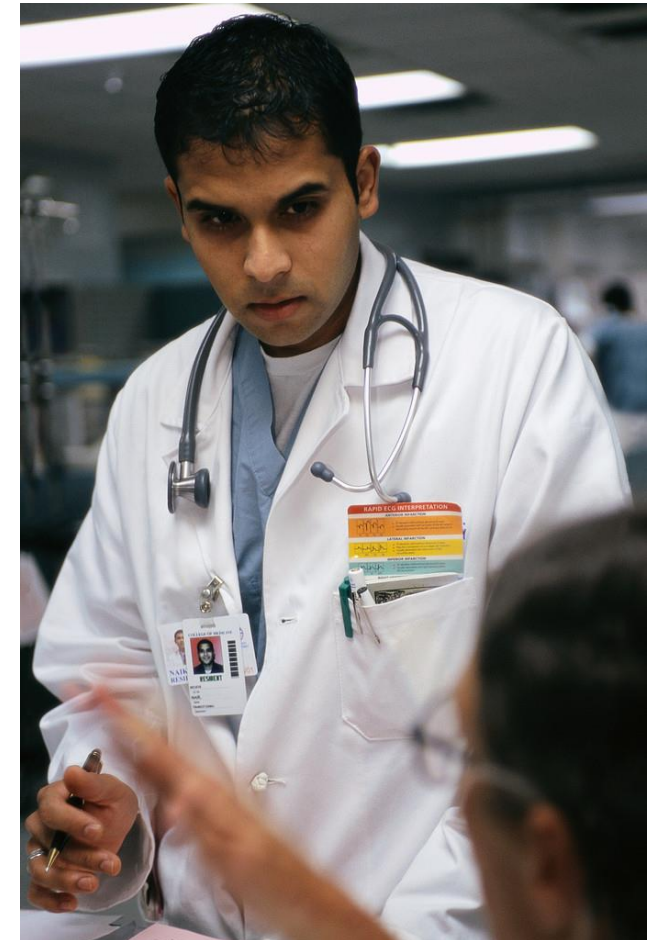
## We underestimate

- Time eyes off road
- Risk of crash



# Health Belief Model

- Developed in the 1950's as a way to identify why people didn't take advantage of health services
  - Mammograms
  - Yearly Physical Exams
  - Cholesterol Testing
  - Immunizations
  - ...."simple" behavior changes
  - Wearing Seatbelts
  - Installing smoke alarms





# Perceptions (beliefs)

- Perceived Susceptibility
  - Will it happen to me?
- Perceived Severity
  - Is it really that bad?
- Perceived Barriers
  - What's getting in my way?
- Perceived Benefits
  - What's "in it" for me?



# Perceived Susceptibility (motivator)

- What are my chances of a fire/CO poisoning anyway?





# PERCEIVED SEVERITY

(Motivator)



- Even if there is a fire, I could put it out
- I would have time to get out
- I would notice if CO was happening

# PERCEIVED BARRIERS

(Enablers)

- Which smoke alarm?
- How much should I spend?
- How do I even know it's working?
- Okay it's in...now what?



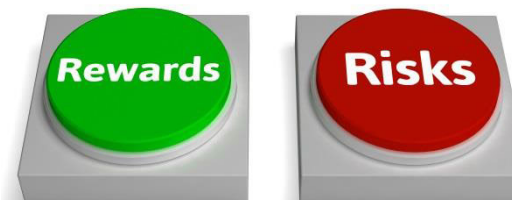
Andrea G. Vastis, MPH

# PERCEIVED BENEFIT

(Reward)

- Will it really work anyway?
- Hard to accept a benefit that hasn't happened
- Each day the person does not have an event it can lessen their perceived "need" to think about fire/CO

Andrea G. Vastis, MPH



# Know your audience...

- What are their perceptions of risk?
- What is their shared history?
- What is their frame of reference for health and safety?
- **"SEEK FIRST TO UNDERSTAND, THEN TO BE UNDERSTOOD"**
  - -STEPHEN R. COVEY





# Why install an alarm now?

Vision 20/20 Marketing Analysis to Support Smoke Alarm Messaging

Peter Mitchell

[peter.mitchell@saltermitchell.com](mailto:peter.mitchell@saltermitchell.com)





# Things we need to worry about

## A PARTIAL LIST

- Air Pollution
- Automobile crashes
- Bullying
- Cancer
- Cholesterol
- Child abduction
- Crime
- Damaging jr's self-esteem
- Deportations
- Depression
- Drowning
- Drugs
- Earthquakes
- Extreme heat
- Fires
- Fish with mercury
- Floods
- Food poisoning
- Gambling addictions
- Global warming
- Guns
- Heat Stroke
- Heart disease
- HIV/AIDS
- Hurricanes
- Identity theft
- Influenza pandemic
- Iraq
- Iran
- Landslide or debris flow
- Mad cow disease
- Male pattern baldness
- Medical errors
- Not enough water
- Nuclear threat
- Obesity
- Old age
- Opioids
- Radiation threat
- Resistant bacteria
- Roofies
- Russian incursions
- Saying the wrong thing
- Serial killers
- STDs
- Terrorism
- Tequila
- Thunderstorms
- Tics / Lyme disease
- Tobacco
- Too much sun
- Tornadoes
- Thunderstorms
- Tsunamis
- TV violence
- Volcanoes
- Voter fraud
- Waistline
- Water pollution
- Wildfires
- Extreme weather
- Zika
- Zits



# What about home fires?



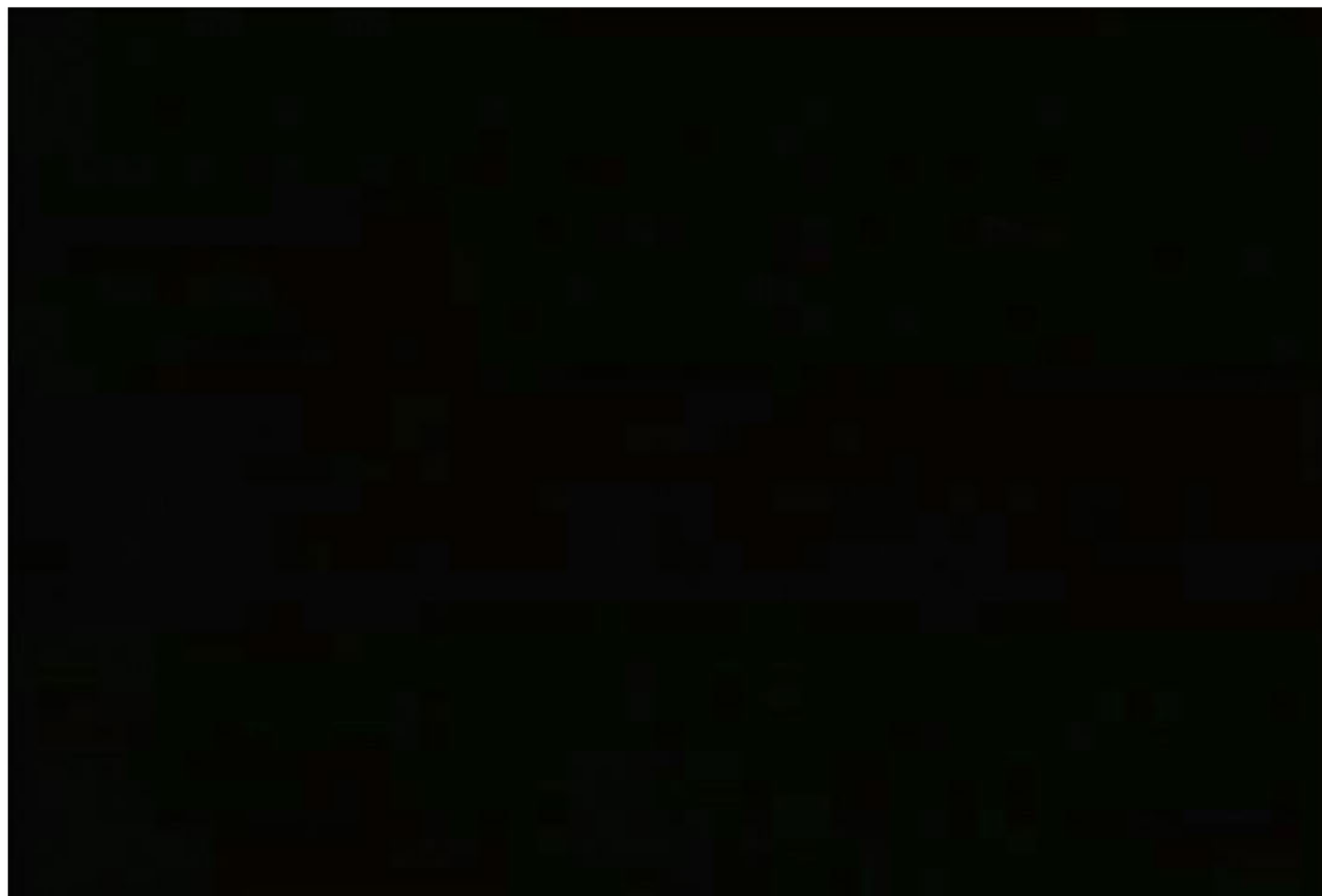
Why should I act now?

- Because there are 364,500 home fires a year

But how much do people expect to be part of that statistic?

- 0.3% of all 1-family and 2-family units catch fire each year
- If I put this off until tomorrow, I have a .0007% of having my home catch fire in the meantime.
- I'm 22 times more likely to get into a car accident tomorrow.



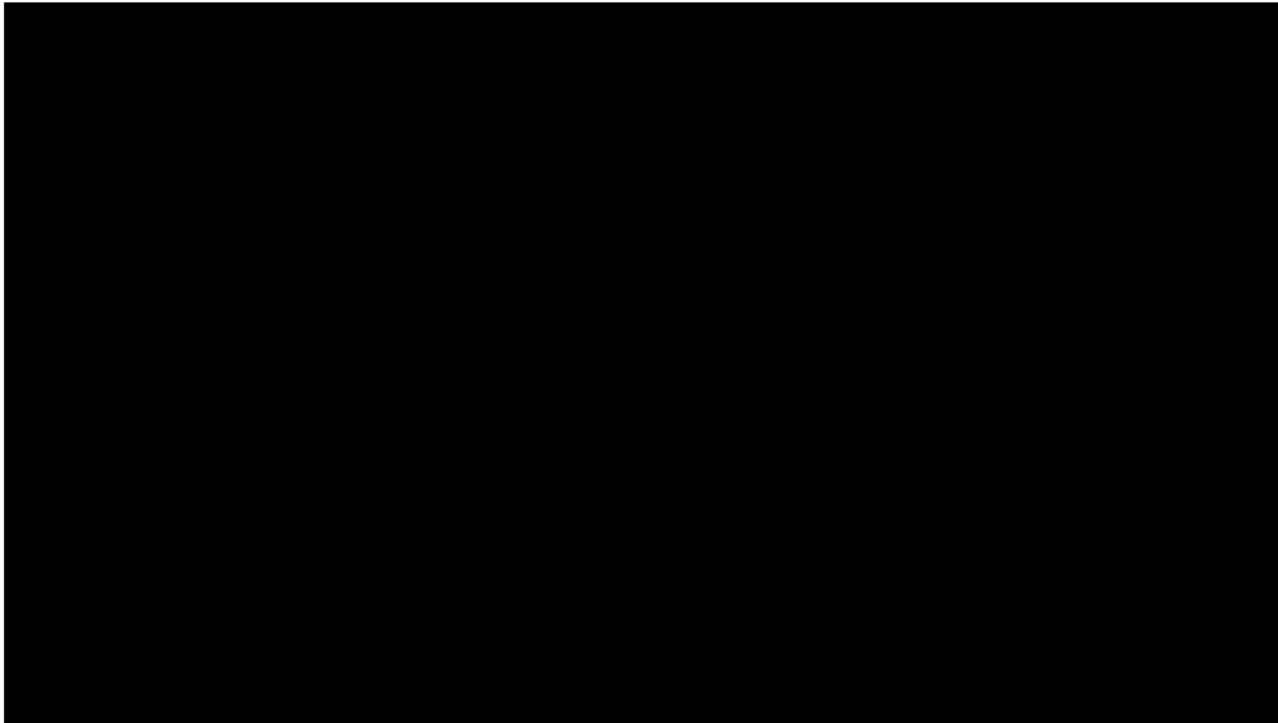


Focus on: What's expected of you  
(norms)



Focus on: A parent's belief about himself  
(self-standard)





Focus on: What people want to do  
(control / self-standard

# Make what's good fun, easy & popular

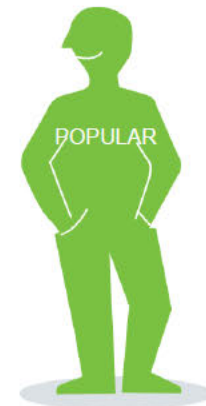
It's not all about risk.



Rewards  
Penalties  
Risks  
Emotions



Skills  
Efficacy  
Environment  
Control  
Investment  
Loss Aversion



Norms  
Self-Standards

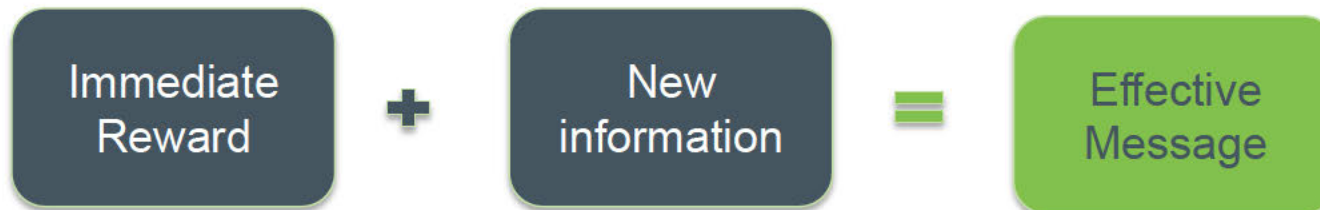
# WHAT WE KNOW FROM RESEARCH

Smoke Alarm messages are NOT simple

- Nuanced
- Multiple actions

Target behavior already known, but suffers from lack of **IMMEDIATE REWARDS** and **NEW INFORMATION**.

## RECOMMENDED MESSAGE RECIPE



# SO WE EXAMINED TWO AUDIENCES



## Consumers:

- What does each message convey to consumer?
- How might each message affect consumer behavior?

## Fire Professionals:

- How do fire professionals views differ, if at all, from consumers?
- How willing are fire departments to distribute message and materials?



# METHODOLOGY

## Consumer Interviews:

- October 23 and 25
- 50 door-to-door interviews
- Tallahassee and Alexandria “high risk” neighborhoods
- Home-owners/renters, various demographics

## Fire Professionals Survey:

- November 6 and 18
- Online survey of 211 fire professionals
- Nationwide, recruited by Vision 20|20

## WHAT WE TESTED

### Three Headlines

Where There is Love, There Are Smoke Alarms.

Smoke Alarms. A Sound You Can Live With

Give a Beep. Smoke Alarms Show You Care.

### Two Calls to Action:

- Protect the Ones You Love/Yourself. Only Working Smoke Alarms Save Lives..
- Test Your Smoke Alarms Today. Sleep Better Tonight.



# MESSAGE DRAFTS

- Headlines A and C were paired with image A. Headline B was paired with image B. Each headline was also paired with image C.

Image A



Image B

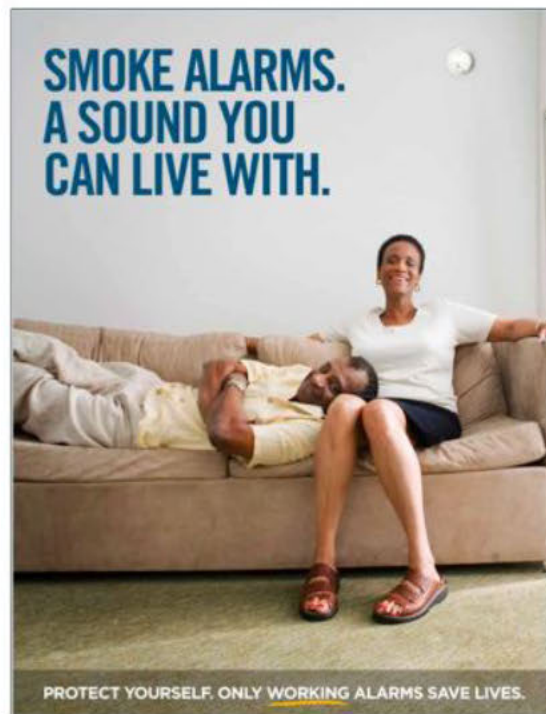


Image C







# CONSUMERS

QUALITATIVE AT-HOME INTERCEPT INTERVIEWS

# OVERVIEW

- High understanding and clarity
- Absence of negative triggers
- Literacy Divide
  - More Literate – word play appealing
  - Less Literate – word play confusing
- Smoke Alarm images = rational response to message
- Human images = emotional response to message and immediacy

# “Where there is love, there are smoke alarms.”

- Connects “love and protection” to “smoke alarms and fire safety.” “Alarm = love” connection was new
- Message interpretation: If you love your family, you should have smoke alarms to protect them.
- Majority had emotional response (happy, safe, secure, protective, worried and warm).
- Lacking catchiness
- Unexpected match with smoke alarm image

# “Smoke alarms. A sound you can live with.”

- Full message misunderstood
- Message interpretation: Smoke alarms can save lives (which they already knew)
- “Sound” primary focus
- No nonsense direction and sentiment appreciated
- Paired best with stand-alone smoke alarm image
- Low literacy difficult to follow

# “Give a beep. Smoke alarms show you care.”

- Fun and catchy for some; offensive to others.
- Message interpretation: Protect the ones you love with smoke alarms.
- Different understanding of “Give A Beep”
  - Test your alarms
  - “Give a [expletive]” – meaning care, be responsible
  - Totally misunderstood (most confusing of all messages)
- Emotional Response: laughter, safety, happiness, protection





- Boy **most associated with love and care**
- Emotive images **unexpected** / new with smoke alarm message
- Parents most emotional connection to boy



- **Matched expectations** for smoke alarm
- **Conveyed fear** and urgency
- **Least engaging**
- Mismatch with messages of love and protection



# Fire Safety Materials Generator

Create fire safety materials that meet the needs of your community. We provide you with the key messages, pictures and designs. All you have to do is answer a few simple questions! Choose one or create them all:



Flyer



Door Hanger

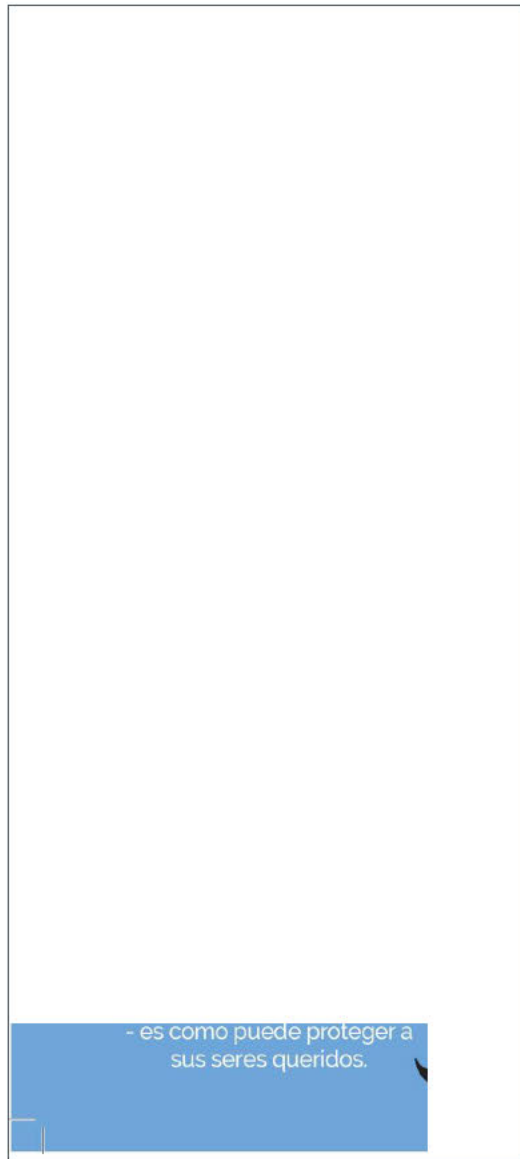


Activity Guide



Refrigerator Card

[GET STARTED](#)



# There Are Smoke Alarms.

**Smoke alarms save lives.** But sometimes they make sounds at the wrong time.

They can beep when you burn food in the kitchen, or chirp if the battery is low. If you remove the batteries, you put your loved ones at risk. But it doesn't have to be that way!

**Here is what you can do to keep everyone you love safe.**

**Problem:** Alarm is chirping  
**How to fix it:** Replace the battery.

**Problem:** Alarm sounds when you are cooking.  
**How to fix it:** Stop the noise. Push the alarm button that says "hush" or "silence."  
Fan the smoke away from the alarm.  
Move the alarm. It should be at least 10 feet away from the kitchen or cooking area.



**FIRE DEPARTMENT NAME**  
URL or Email Address  
Phone Number





# Make what's good fun, easy & popular

It's not all about risk.



Rewards  
Penalties  
Risks  
Emotions



Skills  
Efficacy  
Environment  
Control  
Investment  
Loss Aversion



Norms  
Self-Standards

# Carbon Monoxide Detectors Behavioral Findings

**Scott A. Damon**

Health Communication Lead  
CDC Air Pollution & Respiratory Health Branch

Workshop for Survey on Usage and Functionality of Smoke  
Alarms and CO Alarms in Households  
February 16, 2017

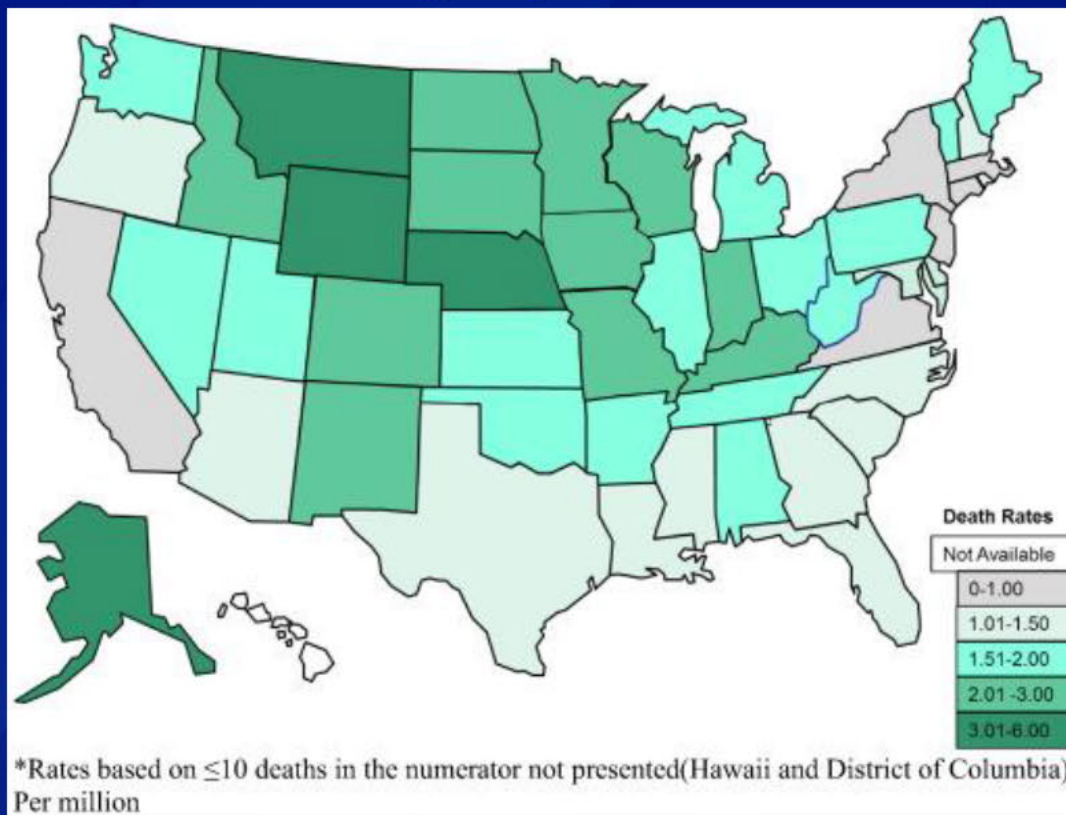
# **Presenter Disclosures**

**Scott A. Damon**

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

# CO Poisoning by state 1999-2012



Age-adjusted UNFR CO Poisoning by state, 1999-2012, United States\*. \*Rates based on  $\leq 10$  deaths in the numerator not presented (Hawaii and District of Columbia). Per million.

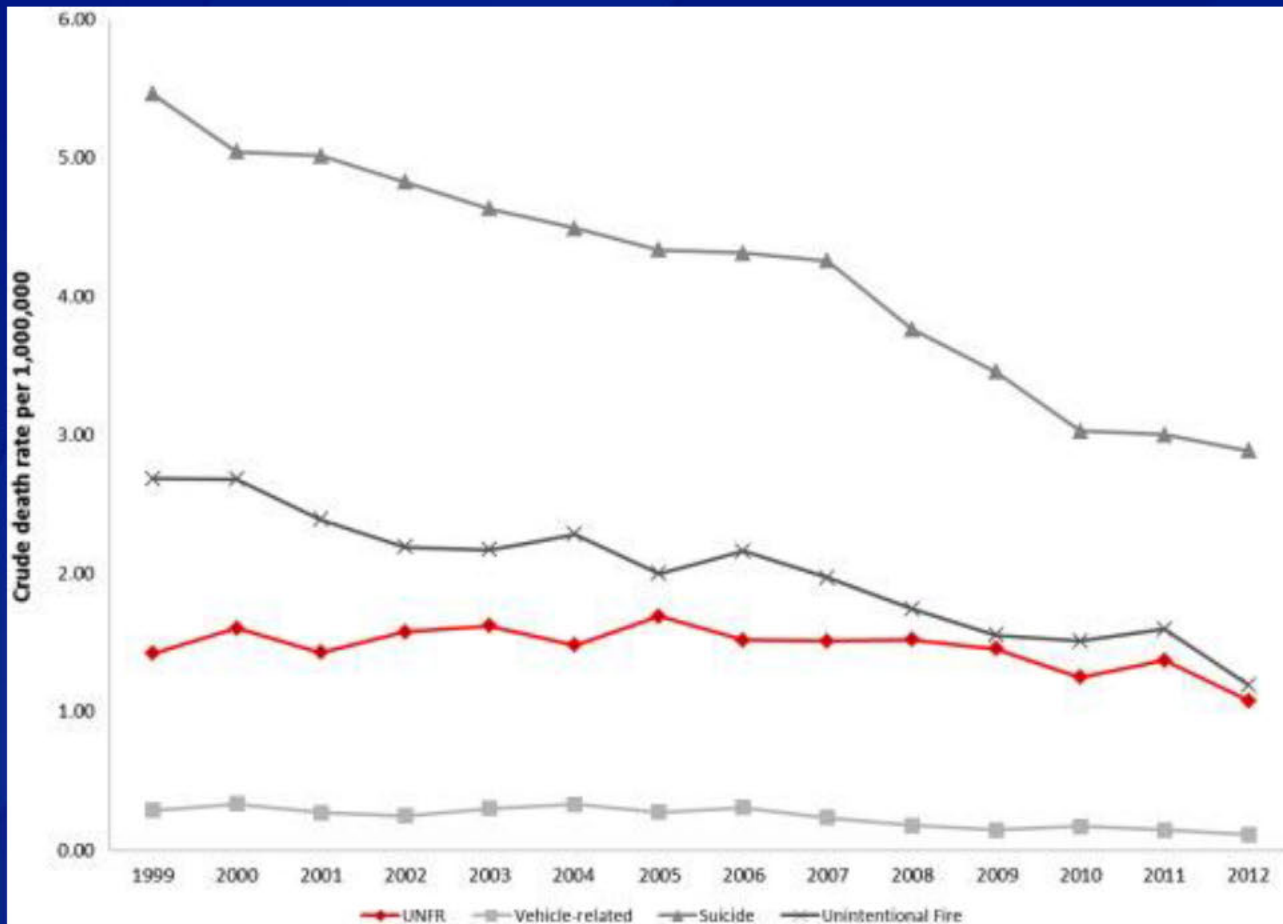
## Surveillance data:

**Sircar K, Clower J, Shin Mk, Bailey C, King M, Yip F.** Carbon monoxide poisoning deaths in the United States, 1999 to 2012. *American Journal of Emergency Medicine* 2015 33 (9):1140–1145.

## Exposure regions for cases of fatal UNFR CO poisoning, 1999 to 2012 (n= 6136)

Variable	Number (percent)
Urban	4355 (71%)
Rural	1781 (29%)
Northeast	733 (12%)
Midwest	1581 (26%)
South	1486 (24%)
West	1932 (31%)

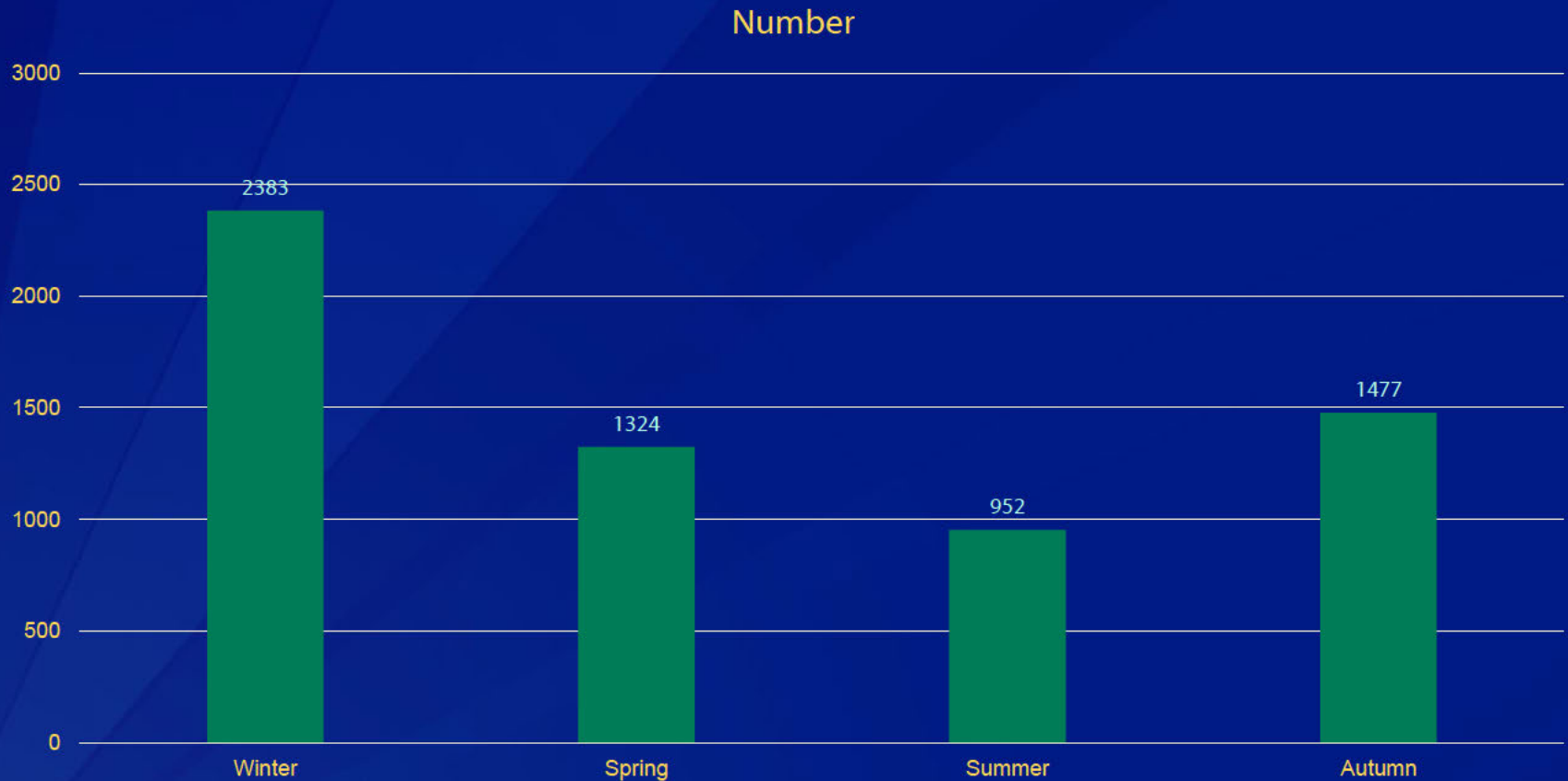
# CO Poisoning Trends 1999-2012



Crude rate of CO poisonings by intent, fire-, and vehicular-relatedness. Trend from 1999 to 2012, United States.



# CO Poisoning Seasonality 1999-2012





## **Estimated cost of CO poisoning**

- ❑ For UNFR CO poisoning, total annual medical cost ranged from \$33.6 to \$38.1 million.
- ❑ Hospitalizations, outpatient hospital visits, and emergency department (ED) visits accounted for approximately two thirds of the medical cost.
- ❑ The benefit-to-cost ratio of installing CO detectors in residences can be as high as 7.9 to 1.

## Historically ...

- ❑ 2005: Hurricanes Katrina & Rita
- ❑ We interviewed 18 households with CO poisonings
- ❑ 6 had detectors
- ❑ 1 detector worked

# Findings from 2006 HealthStyles survey

- ❑ HealthStyles is a mailed panel survey administered by Porter Novelli to measure health knowledge, attitudes, and behaviors of adults in the U.S.
- ❑ A stratified random sample, based on region, household income, population density, age, and household size, was combined with a low-income/minority supplement to create a nationally representative sample.
- ❑ A total of 6,600 HealthStyles surveys were mailed in 2006, with 5,251 households (79.6%) returning complete questionnaires

Styles survey data: King ME, Damon SA. "Attitudes about Carbon Monoxide Safety in the United States: Results from the 2005 and 2006 HealthStyles Survey." *Public Health Reports*, 2011;126 (S1): 100-107

# HealthStyles Questions

In this section, there are a number of statements with which you may or may not agree. For each statement listed, please indicate whether you personally agree or disagree with it.

Likert scale response  
(1 = strongly disagree and  
5 = strongly agree)

## 2005 items

It is safe to run a generator in a basement as long as a window is open.

1 2 3<sup>a</sup> 4<sup>a</sup> 5<sup>a</sup>

It is safe to run a generator in a garage as long as the door is open.

1 2 3<sup>a</sup> 4<sup>a</sup> 5<sup>a</sup>

## 2006 items

→ If you use a gas-powered generator, you should also use a carbon monoxide detector.

1<sup>a</sup> 2<sup>a</sup> 3<sup>a</sup> 4 5

→ It is safe to run a generator in a garage that is not attached to the home.

1<sup>a</sup> 2<sup>a</sup> 3<sup>a</sup> 4 5

→ I don't need a carbon monoxide detector in my house if I have a new furnace.

1 2 3<sup>a</sup> 4<sup>a</sup> 5<sup>a</sup>

It is safe to run a generator in a garage as long as the door is open.<sup>b</sup>

1 2 3<sup>a</sup> 4<sup>a</sup> 5<sup>a</sup>

It is important to have fuel-burning appliances inspected professionally at the beginning of each heating season.

1<sup>a</sup> 2<sup>a</sup> 3<sup>a</sup> 4 5

→ How often do you check the battery in your CO detector? ("X" all that apply)

☐ Do not have a CO detector

☐ Every six months

☐ It beeps when the battery needs to be changed

☐ Once a year

# HealthStyles Findings: 2006

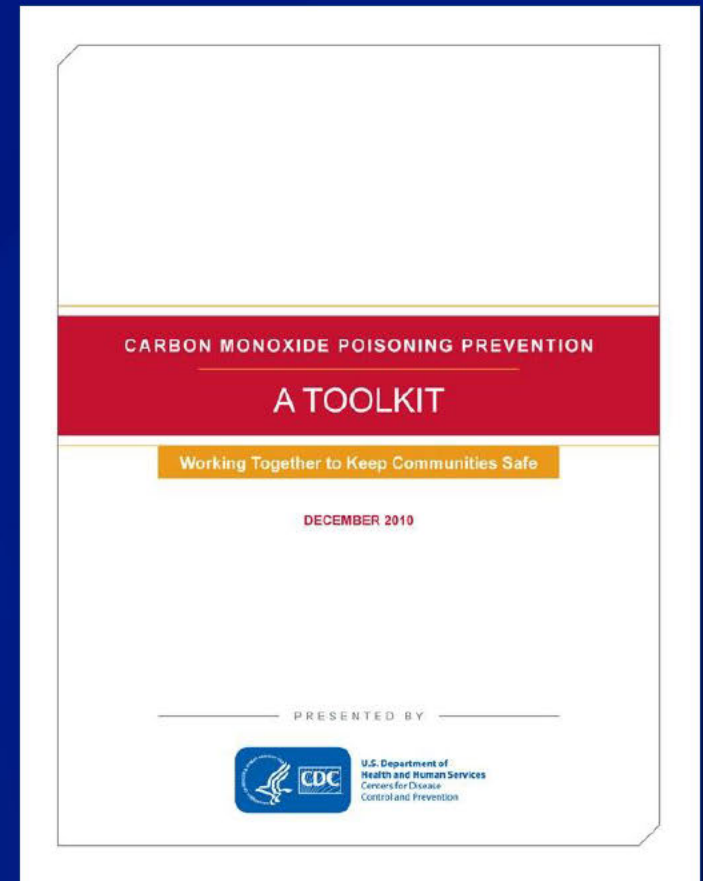
Characteristic	Generator safe in open garage (n=4,927) <sup>b</sup>		Use CO detector with generator (n=4,938) <sup>c</sup>		Generator safe in unattached garage (n=4,917) <sup>d</sup>		No CO detector needed with new furnace (n=5,033) <sup>e</sup>		Annual appliance inspection important (n=5,055) <sup>f</sup>	
	Percent agree	Percent uncertain	Percent agree	Percent uncertain	Percent agree	Percent uncertain	Percent agree	Percent uncertain	Percent agree	Percent uncertain
Total	24.9	36.0	69.8	22.8	19.5	32.4	8.0	15.3	63.5	26.1
Gender <sup>g</sup>										
Male	26.7	34.0	70.3	21.6	21.2	29.2	8.8	15.1	62.8	26.3
Female	23.0	38.0	69.3	23.9	17.8	35.6	7.2	15.4	64.2	25.9
Age (in years) <sup>h</sup>										
18-34	20.2	41.6	67.2	26.6	16.2	40.5	8.1	17.7	53.5	32.5
35-64	26.3	34.6	70.1	22.0	20.4	29.7	7.1	14.3	64.5	25.8
≥65	29.3	29.2	74.4	17.7	23.1	25.1	10.6	13.7	79.6	14.6
Race/ethnicity <sup>i</sup>										
White, non-Hispanic	25.5	35.0	71.3	22.4	19.7	31.8	7.0	14.4	63.5	26.9
Black, non-Hispanic	22.2	37.7	67.5	22.2	20.0	33.3	11.2	13.2	70.5	20.5
Other, non-Hispanic	26.9	32.8	60.6	60.6	17.5	31.6	14.1	20.7	61.4	25.5
Hispanic	22.7	41.5	68.7	68.7	18.9	35.4	7.4	19.3	59.0	27.0
Annual household income <sup>j</sup>										
<\$25,000	24.3	38.4	69.3	22.1	21.1	35.8	7.9	18.5	66.4	24.6
≥\$25,000	25.1	35.2	70.0	23.0	18.9	31.3	8.0	14.1	62.5	26.6
Education										
≤High school	26.3	35.8	66.8	24.9	21.4	32.7	8.5	14.5	65.0	25.0
Some college	25.9	35.3	70.6	22.7	18.9	32.5	6.7	15.7	62.6	26.7
≥College graduate	22.3	37.1	72.2	20.4	17.7	32.6	8.6	15.5	63.3	26.3
Region <sup>k</sup>										
Northeast	26.1	35.9	74.5	20.0	21.2	34.1	6.0	11.4	67.9	24.5
Midwest	29.2	36.5	71.5	21.5	24.1	34.2	7.9	10.7	63.1	27.0
South	22.1	33.2	73.1	19.2	18.2	28.9	9.2	15.7	67.0	22.2
West	23.5	40.3	58.3	32.8	15.1	35.1	7.8	23.3	54.5	33.0

## HealthStyles Most Salient Findings

- ❑ Majority of homeowners recognized that a CO detector was needed even with a new furnace
- ❑ A large proportion of adults in the U.S. believe that it is safe to operate a gas-powered generator in an enclosed space, such as a garage
- ❑ Most of the respondents surveyed—the majority of whom were homeowners—did not own a CO detector.

# Qualitative Studies—The Toolkit project

- ❑ Literature and Data Review
- ❑ Summer Storm Focus Groups
- ❑ Winter Storm Focus Groups
- ❑ Nonemergency residential poisonings
- ❑ Data Analysis & Prototype design
- ❑ Field testing





# CO Knowledge--residential

- ❑ 2009 Focus groups of homeowners and risk behavior related to residential poisoning
- ❑ Participants have heard of CO and know it is an odorless, colorless gas.
- ❑ Many know symptoms of CO poisoning: headache, drowsiness and dizziness.
- ❑ Most participants could name CO sources: furnaces, grills, cars and gas appliances.
- ❑ Many participants confused CO and natural gas, using the terms interchangeably.
- ❑ If CO were present, most participants knew to leave the house and call the fire department. Some would take less appropriate actions (e.g., turning off natural gas, opening windows, checking CO detector for malfunction).

## Qualitative Studies:

Damon SA, Poehlman JA, Rupert DJ, Williams PN. "Storm-Related Carbon Monoxide Poisoning: An Investigation of Target Audience Knowledge and Risk Behaviors." *Social Marketing Quarterly*. 2013; 19:188-199.

Rupert DJ, Poehlman JA, Damon SA, Williams PN (2013). "Risk and protective behaviours for residential carbon monoxide poisoning." *Injury Prevention*; 19(2): 119-123.

## Detector knowledge--residential

- ❑ Most participants have a CO detector, but many do not have adequate alarm coverage.
- ❑ Participants were unsure how many CO detectors to install or where to place them. Many place detectors near furnaces or in basements/utility rooms.
- ❑ Few participants placed detectors in or near bedrooms. None acknowledged a connection between detector location and the ability to hear it.
- ❑ Participants poorly maintain CO detectors. Many do not change batteries regularly.

# Storm related (generators) knowledge

## Both summer & winter storms

- ❑ Most participants were familiar with CO and had heard about CO poisoning. Specifically, participants were familiar with its characteristics (e.g., colorless, tasteless, odorless), knew it often affects sleeping individuals, and recalled that victims were unlikely to know they were being poisoned.
- ❑ None of the participants acknowledged that their generator placement might have exposed them to some level of CO in the past.
- ❑ Participants also recalled most symptoms of CO poisoning (e.g., headache, drowsiness, dizziness) and knew that it could be fatal.
- ❑ Ventilation, fumes, and CO poisoning were the second most common concerns among participants (after electrocution)
- ❑ Almost all participants talked about the need to properly ventilate generators. Few could actually define that
- ❑ Most participants said they were not highly concerned about CO poisoning.
- ❑ Precautions rarely included a CO detector

## Storm related (generators)—detector knowledge

- ❑ Almost all participants were aware of CO detectors and their purpose, although only half of participants had CO detectors installed in their homes.
- ❑ All participants said they understood the difference between CO detectors and smoke alarms, and most understood that CO detectors should be installed in different locations. However, participants were generally unclear on where CO detectors should be installed.
- ❑ Most participants believed that CO detectors would be easy to install, and several participants had installed the detectors themselves.
- ❑ Most participants recognized that they should change their smoke alarm and CO detector batteries twice a year. Several cited the recommendation to change batteries when changing the clocks for daylight saving time. Nevertheless, many participants do not follow this recommendation. Residents most commonly stated that they change the batteries when the alarms are low on power and chirp.
- ❑ Most participants viewed CO detectors as the best way—and, in some cases, the only way—to protect themselves and their family from CO poisoning.

## **Qualitative Research Summary Findings: Lack of Awareness of CO Sources and Detectors**

- Many do not consider themselves at risk.
- Homeowners service their furnaces sporadically; few have annual inspection/ maintenance contracts.
- Many portable generator owners place their generators in enclosed spaces.
- Most are unsure where to place CO detectors or how many they should install.
- Most change batteries “when a detector chirps” rather than every 6 months.

# Laws and Regulations

## ❑ Patchwork nationwide

- Apartment buildings
- New construction and remodeling
- Home sales
- Some hotel

## ❑ Enforcement

## Possible survey topics

- ❑ **Battery maintenance**
  - Detector replacement
- ❑ **Detector placement**
- ❑ **Awareness of laws**
- ❑ **Basic CO knowledge**



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**For more information please contact Centers for Disease Control and Prevention**

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

E-mail: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov) Web: <http://www.cdc.gov>

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



**NATIONAL FIRE PROTECTION ASSOCIATION**

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# Smoke and CO alarm information: What don't we know?

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February 16, 2017 Marty Ahrens, Data Analytics

# Sources of information

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- Most of material is from NFPA's 2015 report, *Smoke Alarms in US Home Fires*
  - NFIRS details combined with NFPA's fire experience survey for national estimates
  - Unless otherwise specified, info is based on reported US fires and from this report
  - Also references other sources, such as CPSC, American Housing Survey, etc.
- We know much less about CO alarms

# We want to know

---

- Level of protection
  - How many, where, what type
- Are they working? If not, why not?
- Unwanted alarms
- Consumer perceptions and understanding

# American Housing Survey data for 2011

---

- Asked about presence of **working** smoke detectors and CO detectors
  - 95% of households reported working smoke detectors, including
    - 91% of households below poverty line
    - 93% of households with householder at least 65 years old
  - 76% of households with smoke detectors powered by batteries or electricity and batteries said they replaced batteries in last six months
- Also asked about working CO detectors
  - 43% of households reported working CO detectors
    - 49% were powered by battery
    - 19% by electricity alone
    - 32% by both electricity and batteries

# How many households have smoke alarms or working smoke alarms?

---

- Phone surveys suggest 95%-97% with smoke alarms present
  - Self-reporting may overstate presence or number working
- In CPSC's 1992 National Smoke Detector Project, 20% of homes with smoke alarms had none that worked
  - *46% of the respondents in households in which no smoke alarms functioned thought that all of them were working*

# What codes are in place?

---

- According to American Housing Survey 2011, 30% of homes that were less than five years old had smoke detectors powered by batteries only
  - Model codes have called for hard-wired smoke alarms for a long time
  - What do codes require in jurisdiction?
    - Are codes enforced? How?



# What portion of fires are first discovered by smoke alarms?

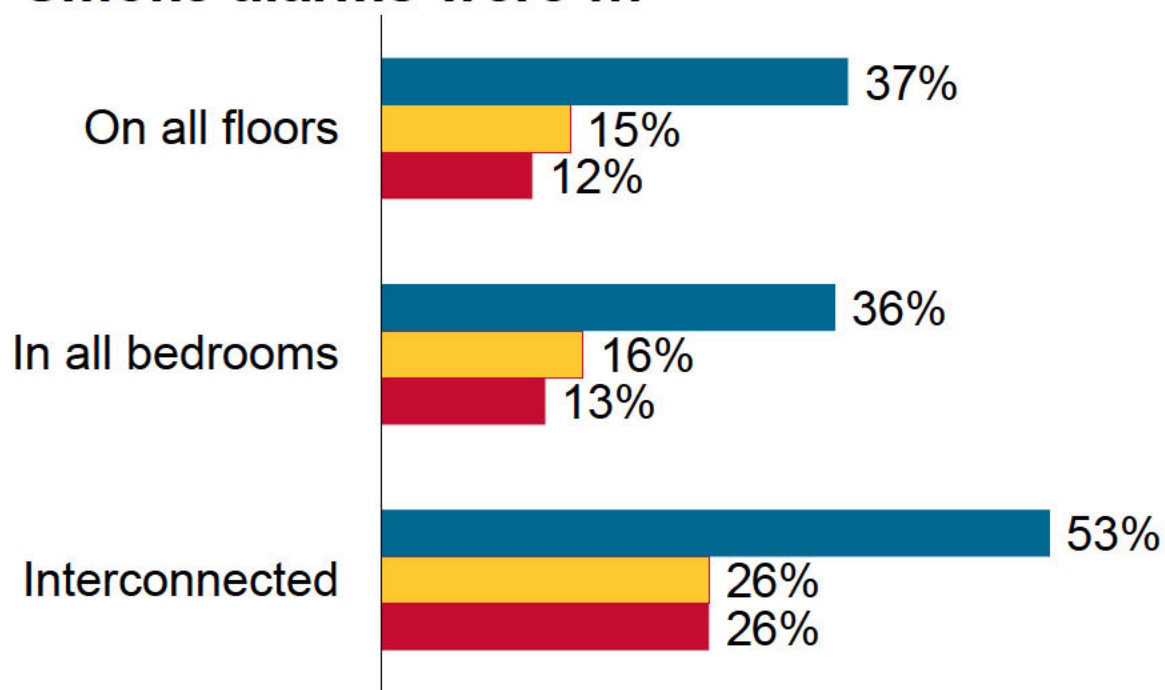
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- In UK, smoke alarms were present, operated and raised alarm in 39% of reported home fires
  - Smoke alarms operated but did not raise alarm in 11%
  - Breakdown:
    - Person raised alarm before activation in 59%
    - No one in earshot in 18%
    - Occupants did not respond in 14%
  - Source: *Fire Statistics, Great Britain, April 2013 to March 2014*
- In roughly half of unreported fires, not enough smoke was present to trigger smoke alarm in CPSC's *2004-2005 National Sample Survey of Unreported Residential Fires*

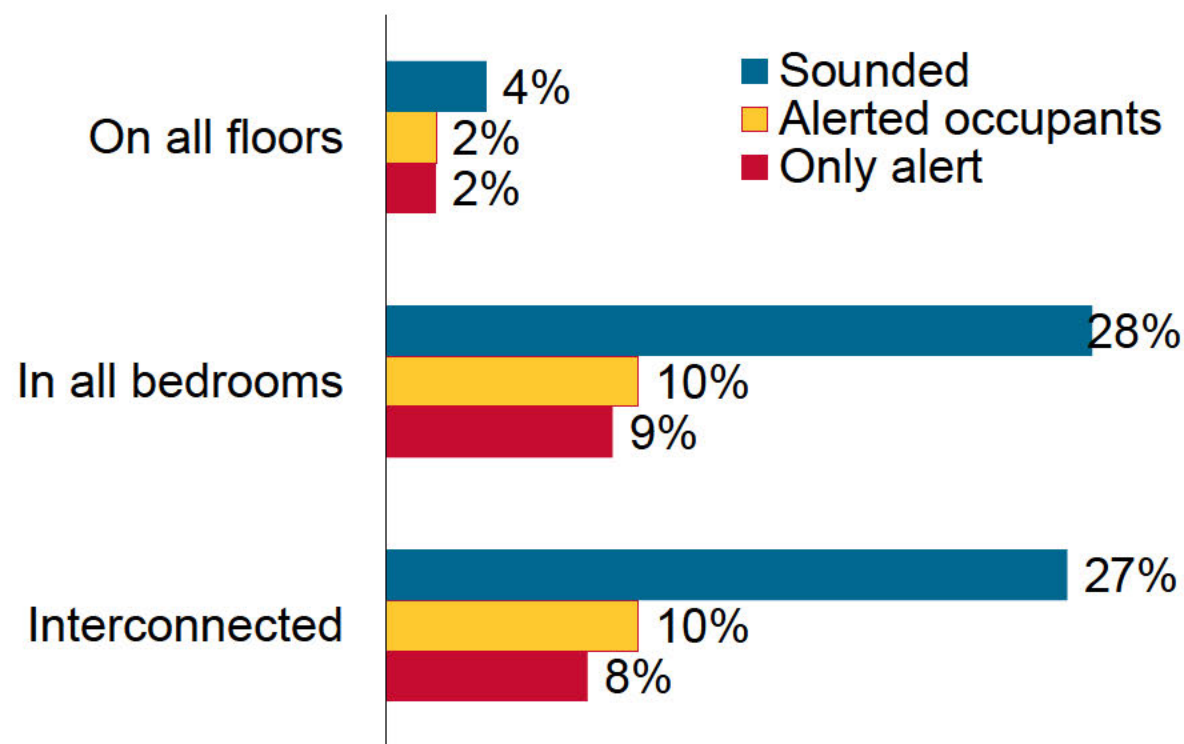
# Smoke alarm sounding, alert, and only alert

- From CPSC's 2004-2005 National Sample Survey of Unreported Residential Fires

## Smoke alarms were ...



## Smoke alarms were not...



# What types of smoke alarms are present?

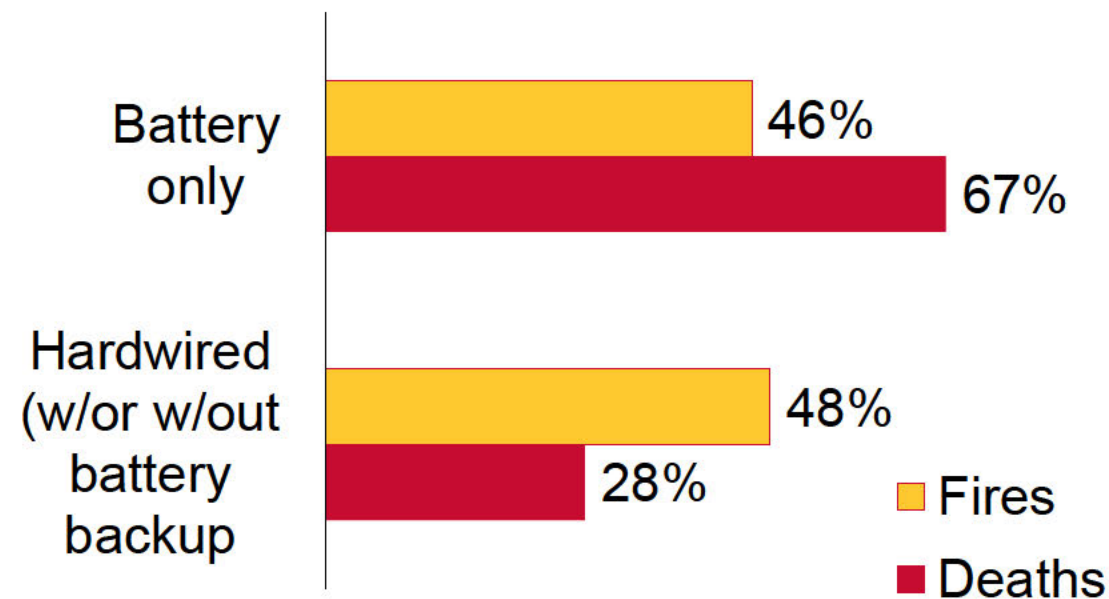
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- Most consumers don't know the difference between photoelectric and ionization
- National Fire Incident Reporting System (NFIRS) asks about smoke, heat, combination smoke and heat, sprinkler water flow detection, multiple types and other
  - Does not
    - distinguish between smoke alarm and smoke detector
    - ask about combination smoke alarm and CO alarm or combination ionization and photoelectric
    - Ask about interconnectivity
      - 2010 Harris poll found about one-quarter of homes had interconnected alarms
  - Also collects very limited information on confined structure fire incident types

# Smoke alarm power sources

- NFIRS does not differentiate between battery types
  - Long-life or conventional
  - Sealed or non-sealed smoke alarms with long-life battery

## Leading Power Sources



# How do smoke alarms age?

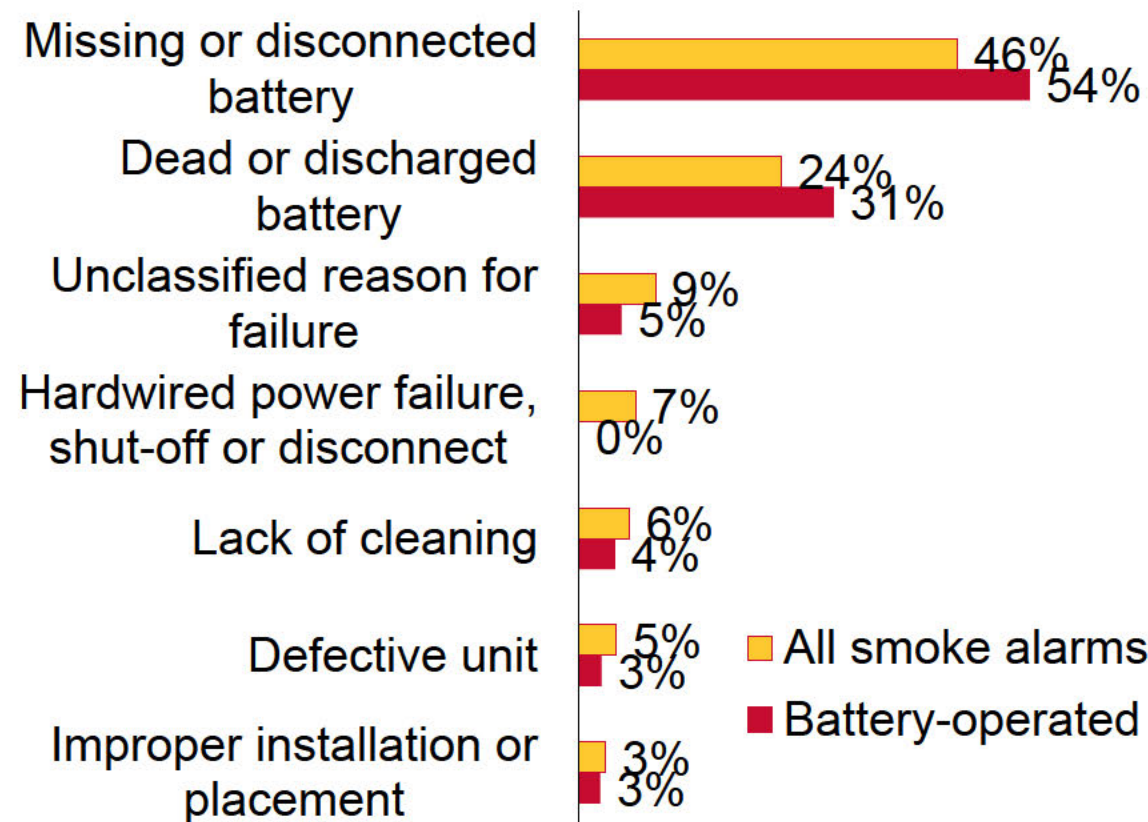
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- In 1997, NFPA issued a fact sheet on 10-year replacement of home smoke alarms
  - Expected failure rate estimated at four per million hours of operation or one every 30 years
  - Early field studies of detector reliability, notably by Canada's Ontario Housing Corporation, found a 2-3% failure rate per year
    - All smoke detectors in Ontario Housing Corporation's units in 1978-1982 were "annually inventoried, cleaned and functionally tested with smoke."
    - Since 1977, every dwelling unit had at least one wired-in smoke detector
  - So, in ten years there is roughly a 30% probability of failure before replacement in 10 years
- CPSC's earlier survey (1994) found home smoke alarms tended to fail totally, not incrementally with a loss of sensitivity
- These tests need to be updated

# Why do smoke alarms fail in fires?

- For battery-powered
  - Long-life or conventional battery?
  - Age of battery
  - If missing or disconnected, why?
- For dead batteries
  - Did unit chirp?
  - Did consumer know what it meant?
- When defective, was it a problem with horn, sensor or something else?
  - Beyond scope of most fire departments

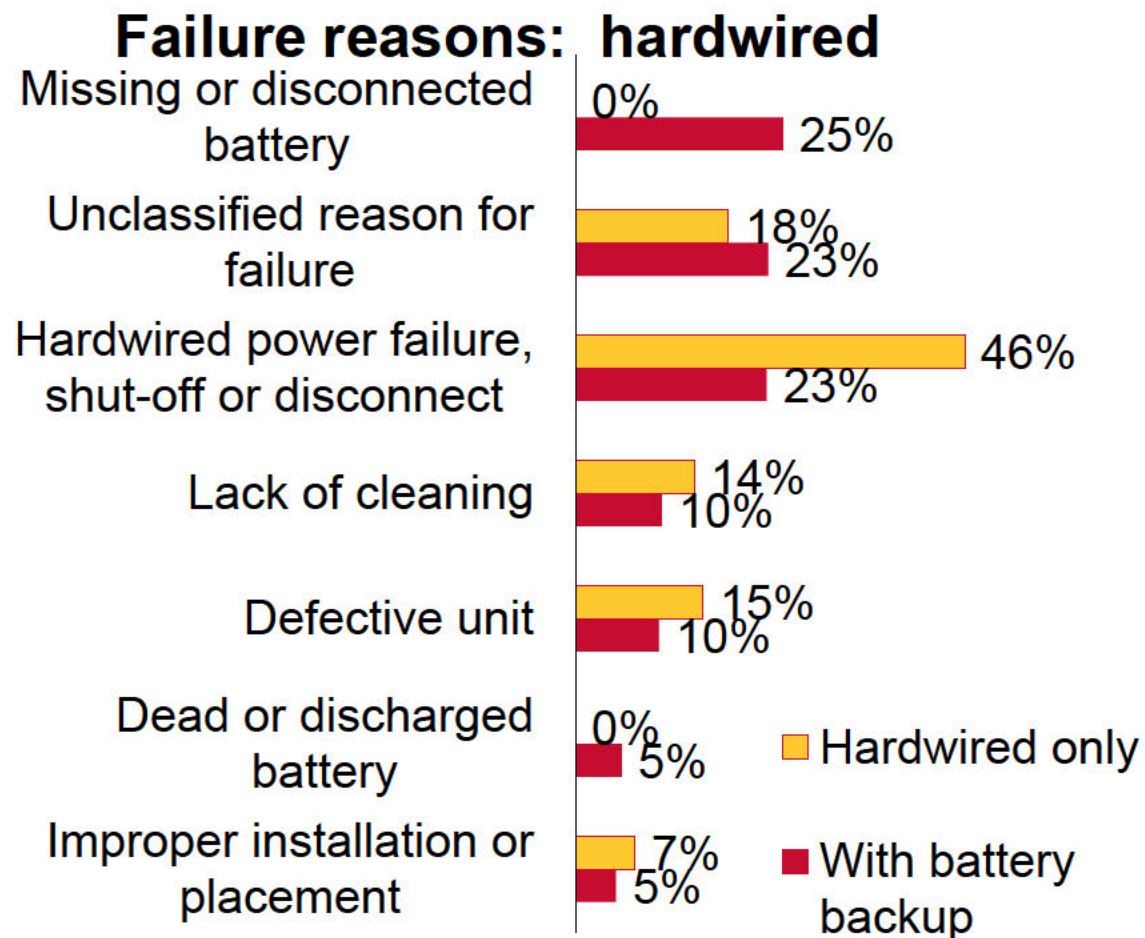
## Failure reasons: all and battery





## Reasons hard-wired smoke alarms fail

- Surprising percentage of battery-related failures for hardwired with battery backup
- Hardwire power failure, shutoff or disconnect does not separate deliberate disabling
- Large percentage of unclassified reasons
- Prior to unknown allocation, failure reason was unknown for half of hardwired vs. one-third of battery-powered





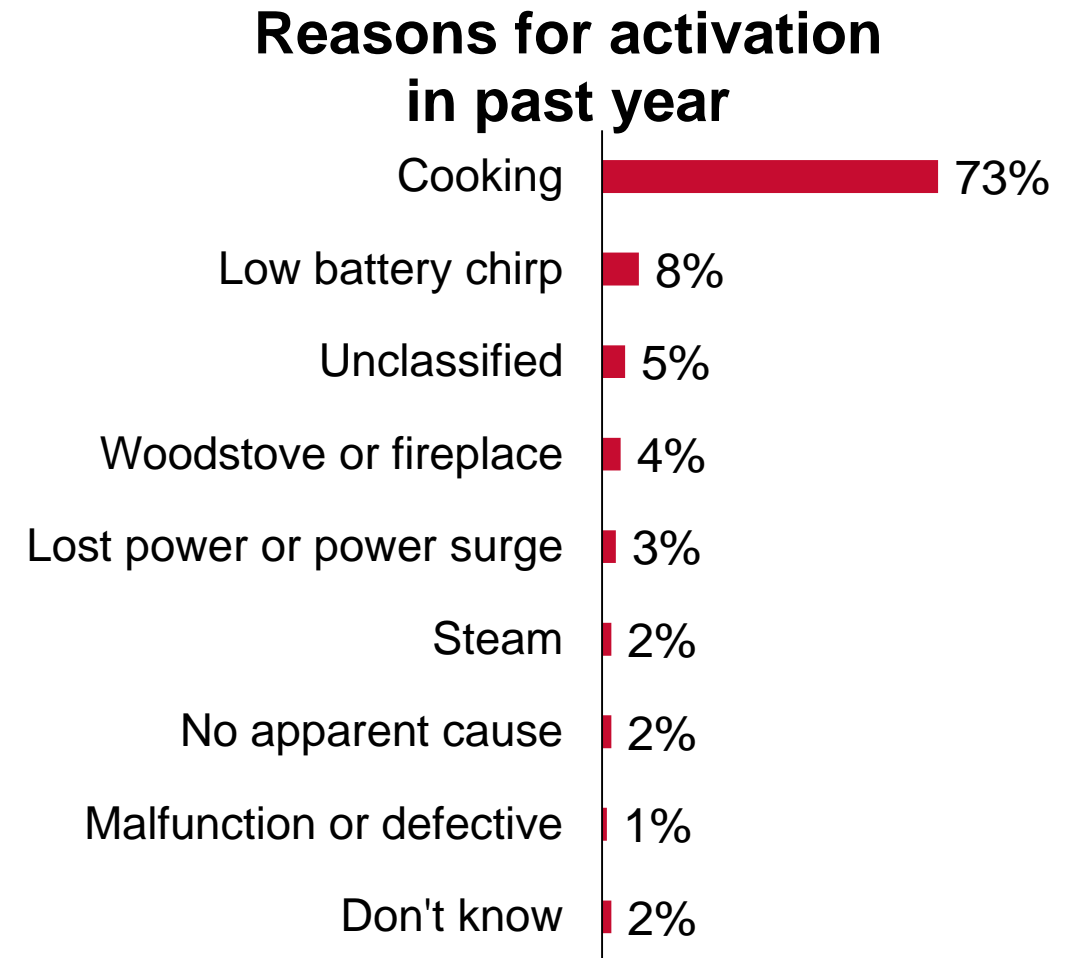
# Smoke alarm failures

---

- More engineering analyses are needed
- From a 2011 Amazon review:
  - “...I heated up the oven, put some food in and went outside for about 10 minutes. I came back in the house and it was FULL of smoke.
  - I heard beeping from a fire alarm. I turned off the oven, opened the windows, then tried to figure out which alarm was beeping. None of the alarms on the walls/ceilings were beeping...
  - Turns out it was an old one I had in a cabinet that I had taken down to install one of these.
  - Then I tested all of these that I have installed. They all worked when I pushed the 'test' button. These should have gone off. The house was FULL of smoke”
- How much smoke is needed to activate alarms?

# How often and why do smoke alarms activate?

- 2010 Harris poll for NFPA
  - 43% said smoke alarms had gone off in past year
- What do you think caused the smoke alarm to go off?
  - Only one response was allowed
  - Note that no one said “fire”



# Different reasons when asked to agree or disagree with “The last time a smoke alarm sounded, it...”

- Additional Harris poll question show more benefits from smoke alarms



# Issues with monitored systems

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- 1989 NIST study *False Alarm Study of Smoke Detectors in Department of Veteran Affairs Medical Centers* found
  - 15.8 activations for every real alarm
  - One unwanted activation for every six devices
  - Similar current studies are needed
- What policies and SOPs are in place for fire department responses to unwanted alarms?
  - Fines?
  - Level of fire department response?
  - Investigation?
  - Level of ITM and plans

# Issues with interconnected alarms

---

- Does consumer know how to tell which alarm is sounding?
- Does consumer know how to shut off?
- Why do some seem to go off randomly, particularly at night?
  - From two different brands:
  - “I replaced all the smoke detectors in my house with these in May 2012 (a total of 11). I replace the 9 volt batteries every year. Starting in early 2016 ... one by one the smoke alarms went bad... randomly going off (a full on alarm, three loud beeps, then a pause of 4 to 5 minutes then more loud alarm beeps... I have been taking them down as they go bad and now have less than 50% of them properly installed... “ Amazon January 8, 2017 review
  - “JUNK! Just bought January 31 2016 and can no longer return ...because it's past the return time. I replaced my 10 year old (working fine) smoke detectors for this same brand and they are already defective setting off the whole house at 11PM for NO REASON! “ Amazon March 11, 2016 review
- Damage to consumer trust?

# Battery issues

---

- How often are lithium-ion batteries failing early?
  - Amazon reviews have expressed frustration
- How often are lithium-ion batteries replaced by conventional batteries?
- Why do some interconnected smoke alarms chirp even with new batteries?
- How often does chirping begin in the middle of the night?
  - How often does night-time chirping cause immediate disabling?
- Chirping as a nuisance to neighbors

# In NFIRS, what's a fire? What's an unwanted alarm?

---

- Incident type instructions do not include a clear definition of fire
  - Situation found vs out on arrival
- In each city, about one-third of incidents with “investigate fire out on arrival” as an action taken were not classified as a fire in the incident type field
  - Numerous incidents coded in the 650 (smoke scares) and 740s (unintentional activations of fire protection equipment) series where fire extinguishers were deployed before fire department arrival

Source: *NFPA's NFIRS Incident Types: Why aren't they telling a clearer story?*



# What's a CO incident?

---

- NFIRS 5.0 *Complete Reference Guide* incident type 424
  - “Carbon monoxide incident. Excludes incidents with nothing found (736 or 746)”
- NFIRS data dictionary (used for pull-down menus, text searches)
  - “Carbon monoxide incident”
  - Narratives for 424 show many CO alarm activations with nothing found
  - Fire department had tested for CO

# Summary

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- There's a lot we don't know
- Technology has changed more than data collection
- With surveys, it matters how we ask question
  - Self-reports may not be reliable
  - Consumers may not know relevant specifics
- Going into homes is crucial
- New engineering analyses are needed
- Project is so needed



## **NATIONAL FIRE PROTECTION ASSOCIATION**

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# **National Smoke and CO Alarm Survey**

---

## **Vision 20/20 Draft Protocol and Questionnaire**

**Philip Schaenman  
Managing Member  
TriData LLC  
Arlington, VA**





# Survey Advisory Group

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**American Red Cross**

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**Consumer Product Safety Commission**

**Attorney; Director, Project Paradigm**

**National Electrical Manufacturer's Assoc.**

**Johns Hopkins University**



# TriData Survey Project Staff

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**Project Manager**

**Dr. Ed Sondik**

**Principal Scientist; former Director of NCHS**

**Maria Argabright**

**Survey Analyst**





# Survey Purposes

- **Assess national status of home smoke and CO alarm protection.**
- **Establish baseline for future programs.**
- **Inform national code organizations of compliance with current codes for smoke and CO alarms.**
- **Improve targeting of fire safety education.**
- **Provide “news” to inject into prevention efforts.**
- **Assist researchers and manufacturers with information on failed smoke and CO alarms.**





# Survey Protocol

- Sample 80 ZIP codes
- Identify fire departments in each
- Choose random sample of homes and apartments (40 per ZIP code)
- Choose local survey team, e.g., fire inspector plus survey professional
- Contact homes with letter or phone call
- Deal with refusals
- Get permission for apartments



# Survey Protocol

*(continued)*

- **Conduct visits**
- **Record data (SurveyMonkey or similar)**
- **Replace alarm or battery if needed**
- **Add alarms if needed (one per level, or enough to meet code?)**
- **Send failed alarms to NIST, FM, or other**
- **Analyze data**



*(For e [redacted] arm)*

- Working or not – test button
- Type (photo, ion, hybrid, hearing aid)
- Power (removable/sealed battery, electric)
- Interconnected?
- Private alarm system?
- Age (especially whether over 8 years )
- Location (room, level)
- Properly located in room?
- NOT brand, to avoid commercial issues



*(For who [REDACTED] home)*

- At least one working alarm per level on arrival ? End of visit?
- # working smoke alarms, # non-working on arrival; at end of visit?
- # alarms added or given batteries?





# Data to Collect from Occupants

- **Alarms and detectors**
  - Did occupant know where each alarm was?
  - Do they test their alarms? How often?
  - Did they know they had alarms not working?
  - Did they know they needed a CO detector?



# Data to Collect from Occupants

*(continued)*

- **Fire and CO history of home**
  - Fire in past year? Reported?
  - Did smoke alarm provide first warning?
  - Do they have escape plan? Exercised?
  - Did they buy alarms since being contacted?
  - Has the CO alarm gone off in past year?
  - Was fire department called?
  - True CO hazard, or false alarm?



# Data to Collect from Occupants

*(continued)*

- **Demographics of Household**
  - Rent or own home?
  - # people living in home
  - Race/ethnicity
  - # occupants under 5 years old? Over 65?
  - # occupants with disabilities
  - Anyone with hearing problem?
  - Any smokers?
  - Household income range



**SURVEY FOR NATIONAL SMOKE  
AND CARBON MONOXIDE ALARM SURVEY**

---

Date of visit: \_\_\_\_\_

Name of occupant: \_\_\_\_\_

Street address: \_\_\_\_\_ Apt. #: \_\_\_\_\_

City and state: \_\_\_\_\_ ZIP \_\_\_\_\_

Home phone: \_\_\_\_\_

**IF THE ANSWER TO A QUESTION IS "0" OR "NONE", ENTER "0".  
Do not leave it blank, please.**

Time visit started: \_\_\_\_\_

**1. Type of home**

- ☐ Detached house
- ☐ Mobile home
- ☐ Duplex
- ☐ Multifamily apartment building
- ☐ Townhouse
- ☐ Other \_\_\_\_\_

**2. If entry to residence was not possible, what was the main reason?**

- ☐ No one home
- ☐ Only a minor was home
- ☐ Vacant home/lot—bad address
- ☐ Language barrier
- ☐ Occupant refused entry (Why? \_\_\_\_\_)
- ☐ Other \_\_\_\_\_

**3. Names of surveyors making the visit:**

\_\_\_\_\_

**4. Positions of surveyors (check all that apply)**

- ☐ Fire Inspector
- ☐ Other Prevention Bureau (not inspector)
- ☐ Other Firefighter (not prevention)
- ☐ Private sector firm
- ☐ Red Cross
- ☐ Community volunteer
- ☐ Other \_\_\_\_\_

**Suggested Preamble** to get in the door- surveyors can alter as applicable):

*"Hi, we are here as part of the national survey on fire safety that we told you about by mail [or phone or a previous visit.]. I am firefighter [Tim Jones] from your [XYZ] fire department, and this is [Laurie Smith] from the [ZZZ organization]."*

Show them a fire department credential, preferably not a badge. Have copies of letters endorsing the survey from the local fire department, CPSC, and/or American Red Cross, to show if needed.

*"We would like to check whether your smoke alarms are working, and whether you have a working carbon monoxide detector. If any are not working, or you need more, we will install new ones for free."*

*"The information we collect will be confidential. Your home will not be identified in the survey results. So, can we start?"*

**5. Do you have any smoke alarms?**

- ☐ Yes  
☐ No  
☐ Don't know

**6. Does anyone in the household ever test the smoke alarms?**

- ☐ Yes  
☐ No  
☐ Don't Know

If Yes:

**6a. About how often?**

- ☐ Monthly  
☐ Quarterly  
☐ Yearly  
☐ Once every few years  
☐ Never  
☐ Other \_\_\_\_\_

If No:

**6b. Why don't you test them?**

- ☐ Did not know you should test  
☐ Did not think it was important enough  
☐ Did not know how to test  
☐ Don't test because they go off occasionally  
☐ Physically unable to reach or test  
☐ Don't know

*If they said yes, they had alarms, ask "Could you show us your smoke?" If they said they did not have alarms, ask "Can we look around, and install ones where needed?"*

**SMOKE ALARMS** For each smoke alarm, fill in the following data. The computer will automatically cue up another set of these questions for the second, third, etc. alarm. The first smoke alarm data elements will be numbered 7-1a, 7-1b, 7-1c, etc. The second smoke alarm data elements will be 7-2a, 7-2b, etc. The third alarm will be 7-3a, 7-3b, etc.

**7-1a. Level of home it is on?**

- ☐ Basement
- ☐ First level
- ☐ Second level
- ☐ Third level
- ☐ Attic
- ☐ Other \_\_\_\_\_

(NOTE: For an apartment, treat it as first level unless more than one level. Do NOT report what floor of the building it is on.)

**7-1b. Area or Room of home?**

- ☐ Hallway outside of bedrooms
- ☐ Hallway - other
- ☐ In Family room/living room
- ☐ In Kitchen
- ☐ In Dining area
- ☐ In Bathroom
- ☐ In Closet
- ☐ Other area \_\_\_\_\_

**7-1c. Was the location of the alarm reasonably satisfactory?**

- ☐ Yes, satisfactory
- ☐ Marginally satisfactory
- ☐ No
- ☐ Not sure

**7-1c1. If No or Marginal, what was the problem?**

- ☐ Too close to kitchen
- ☐ In a dead space
- ☐ Too close to air vents
- ☐ Mounted too high
- ☐ Other \_\_\_\_\_

**7-1d. Test result?**

- ☐ Working
- ☐ Not working
- ☐ Could not test

**7-1d1. If could not test, why not?**

- ☐ Could not reach
- ☐ Homeowner would not allow
- ☐ No time
- ☐ Other \_\_\_\_\_

Getting the following data items probably will require taking the alarm down.

**7-1e. Type of alarm?**

- ☐ Photoelectric
- ☐ Ionization
- ☐ Combined photo/ion
- ☐ Combined with CO
- ☐ Hearing impaired

**7-1f. Power source?**

- ☐ Replaceable battery
- ☐ Sealed battery
- ☐ Electric
- ☐ Unknown

**7-1g. Interconnected with other alarms?**

- ☐ Yes
- ☐ No
- ☐ Unknown

**7-1h. Part of private alarm system?**

- ☐ Yes
- ☐ No
- ☐ Unknown

**7-1i. Age of alarm**

- ☐ Less than 1 year
- ☐ 1-4 years
- ☐ Over 4, less than 8 years
- ☐ Over 8 years (replace)
- ☐ Unknown

7-1j. Was this alarm or its battery replaced during the visit?

- ☐ Yes, alarm replaced  
☐ Yes, battery replaced  
☐ No

**End of data for first smoke alarm. Repeat 6a-j for each other smoke alarms.**

When finished recording data on the smoke alarms, ask the occupant the following if any alarms were not working:

8. Did you know that some of your alarms were not working?

- ☐ Yes  
☐ No  
☐ Not Sure  
☐ Not Applicable—all working

If Yes:

8a. How did you know that?

- ☐ We tested them  
☐ We took out the battery because it was a nuisance  
☐ We took out the battery to use elsewhere  
☐ Other \_\_\_\_\_

8b. What is the main reason the alarms were not fixed or replaced?

- ☐ Did not get around to it  
☐ Did not know how to fix or replace  
☐ Can't install or fix them  
☐ Can't afford new ones  
☐ They are a nuisance when they go off  
☐ It's the landlord's responsibility  
☐ Other reason \_\_\_\_\_  
☐ Not sure

After testing all smoke alarms, fill in the following summary information.

9. Number of smoke alarms working, upon arrival? \_\_\_\_\_

10. Number of smoke alarms NOT working, upon arrival? \_\_\_\_\_

11. Was there at least one working smoke alarm on each level of the home, upon arrival?

- ☐ Yes  
☐ No

12. Number of smoke alarms working when you left? \_\_\_\_\_

**CO ALARMS**

13. *Ask occupant:* Do you have any Carbon Monoxide (CO) detectors?

- ☐ Yes  
☐ No  
☐ Don't know

*If Yes, ask: Could you show us where they are?*

13a. *If No, ask: Can you tell me the reason you don't have a CO detector?*

- ☐ Don't know what they are  
☐ Didn't know I needed them  
☐ Don't know where to get them  
☐ It's too much of a hassle to get them  
☐ I can't install them  
☐ My landlord is supposed to provide them  
☐ Can't afford them  
☐ Other \_\_\_\_\_  
☐ Don't Know

Fill in the following data elements for each CO alarm. Note that a few lists are slightly different from the smoke alarm lists.

14.1a. Level of home

- ☐ Basement  
☐ First level  
☐ Second level  
☐ Third level  
☐ Attic  
☐ Other \_\_\_\_\_

14.1b. Room of home

- ☐ Hallway outside of bedrooms  
☐ Hallway - other  
☐ Family room/living room  
☐ Kitchen  
☐ Dining area  
☐ Bathroom  
☐ Closet  
☐ Other area \_\_\_\_\_

14.1c. ~~Was~~ location of the CO alarm reasonably satisfactory?

- ☐ Yes  
☐ No  
☐ Marginal  
☐ Not sure



**14-1ca If No or Marginal: What was the problem?**

- ☐ Too close to kitchen
- ☐ In a dead space
- ☐ Too close to air vents
- ☐ Mounted too high
- ☐ Other \_\_\_\_\_

**14.1d. Test result**

- ☐ Working
- ☐ Not working
- ☐ Could not test

**14.1da. If could not test, why?**

- ☐ Could not reach
- ☐ Homeowner would not allow
- ☐ No time
- ☐ Other \_\_\_\_\_

The following questions may require examining the CO alarm.

**14.1e. Power source**

- ☐ Replaceable battery
- ☐ Sealed battery
- ☐ Electric
- ☐ Unknown

**14.1f Interconnected with other alarms?**

- ☐ Yes
- ☐ No
- ☐ Unknown

**14.1g Part of private alarm system?**

- ☐ Yes
- ☐ No
- ☐ Unknown

**14.1h Age of alarm**

- ☐ Less than 1 year
- ☐ 1-4 years
- ☐ Over 4, less than 8 years
- ☐ Over 8 years
- ☐ Unknown



14.ii. Was this alarm or its battery replaced during the visit?

- ☐ Yes, alarm replaced
- ☐ Yes, battery replaced
- ☐ No

End of data for first CO alarm found. Repeat section for each other CO alarm.  
Then answer the following questions summarizing what was found about the CO alarms.

15. How many CO detectors were working, upon arrival? \_\_\_\_\_

16. How many CO detectors were not working, upon arrival? \_\_\_\_\_

16a. Of the CO detectors not working, how many were taken away? \_\_\_\_\_

17. How many CO detectors were working when you left? \_\_\_\_\_

*After evaluating the alarms, complete the following. Some questions will be answerable by what you saw to this point; others will require asking the occupants for the information.*

#### ALARMS AND DETECTORS

18. Did the occupant know the location of the smoke alarms?

- ☐ Knew all
- ☐ Knew most
- ☐ Knew some
- ☐ Knew none
- ☐ Did not know what the alarm was
- ☐ No smoke alarms present

19. Did the occupant know the location of the CO alarms?

- ☐ Knew all
- ☐ Knew most
- ☐ Knew some
- ☐ Knew none
- ☐ Did not know what the CO alarm was
- ☐ No CO alarm present

20. If any CO alarms present on arrival, ask; do you ever test your CO detector?

- ☐ Yes
- ☐ No

21. If no CO alarms present on arrival, ask: Did you know that you needed a CO detector?
- ☐ Yes
- ☐ No

#### FIRE AND CO HISTORY

22. Were there any fires in this home during the last 12 months? Please fires that were too small to call the fire department.
- ☐ Yes
- ☐ No
- ☐ Don't Know
- 22a. If Yes: Did any of the smoke alarms go off during the fire(s)?
- ☐ Yes
- ☐ No
- ☐ Don't Know
- 22b. Did the smoke alarm(s) give you first warning in any of these fires?
- ☐ Yes
- ☐ No
- ☐ Don't Know
23. Has your CO detector(s) ever gone off?
- ☐ Yes
- ☐ No
- ☐ Don't Know
- 23a. If Yes, what did you do when it went off? (check all that apply)
- ☐ Left the house
- ☐ Called the fire department
- ☐ Ventilated home (opened windows, door, used fan, etc.)
- ☐ Unplugged it
- ☐ Other action \_\_\_\_\_
- ☐ Don't remember
24. After we contacted you to arrange for this visit, did you buy any additional smoke or CO alarms, or replace any batteries?
- ☐ Yes
- ☐ No
- ☐ Don't Know

If Yes:

24a. How many smoke alarms? \_\_\_\_\_

24b. How many CO detectors? \_\_\_\_\_

#### DEMOGRAPHICS

25. Do you own or rent this home (or apartment)?

- ☐ Own  
☐ Rent  
☐ Don't Know

26. How many people live here? \_\_\_\_\_

27. Any children under age 5? (note how many) \_\_\_\_\_

28. Any people over age 65 (note how many) \_\_\_\_\_

29. Any people who are deaf or hard of hearing? (note how many) \_\_\_\_\_

30. Any other people who are physically or mentally challenged, for example vision impaired, mobility impaired, or other physical or mental challenges? (note number excluding hearing) \_\_\_\_\_

31. Do any people in the home smoke?

- ☐ Yes  
☐ No  
☐ Don't Know

32. What is the race or ethnic groups of the people in this household?  
 (can check more than one)

- ☐ American Indian or Alaska Native  
☐ Asian  
☐ Black or African American  
☐ Hispanic or Latino  
☐ Native Hawaiian or Other Pacific Islander  
☐ White  
☐ Other

33. What is the approximate combined annual income for all occupants in the home?

- ☐ Under \$25K  
☐ \$25-50K  
☐ \$50-\$100K  
☐ Over \$100K

Thank you so much for participating in this survey. You can call us if you have any questions about fire or CO safety.

Time visit ended: \_\_\_\_\_

# Consumer Product Safety Commission (CPSC)

## Survey on Usage and Functionality of Smoke Alarms and Carbon Monoxide Alarms in Households

**February 2017**



# Agenda

## ★ Survey Overview

## ★ Survey Topics review:

- Introduction
- House Characteristics
- Status of Smoke and CO detectors
- History of fire alarms
- CO Awareness/ History
- Smoke/ CO functionality test
- Alarms and Detectors
- Housing Demographics



# Survey Overview

- ★ National cross-sectional survey.
- ★ Representative sample of US households.
- ★ Targeted sample size: 1,200 (present funding for 450 homes).
- ★ Mode: in-home interviewer assisted survey (face-to-face interviews).
- ★ Survey focus
  - Status, usage, functionality, awareness of smoke and CO alarms;
  - Collect direct data from smoke and CO alarms functionality test





# Survey Topics

## 1. Introduction:

- Preamble and explanation of the study and the survey purpose;
- Respondent's consent to participate.

## 2. House characteristics:

- Location;
- Housing type and characteristics (single housing, apartment/condo, mobile, etc.).



# Survey Topics

## 3. Status of Smoke and CO alarms in the residence:

- Availability of Smoke and/or CO alarms
- History of testing smoke alarms
- Knowledge of functionality of alarms at home
- Reasons for non-functioning alarms

## 4. Fire and alarms history:

- Accidental fires
- Indication of a warning
- False alarms



# Survey Topics

## 5. CO History/ Awareness:

- Knowledge of carbon monoxide and CO alarms
- History of testing CO alarms
  - Reasons for not testing
- Reaction to CO alarms



# Survey Topics

6. Smoke/CO alarms functionality test

7. Collected information on alarms:

- Type of alarm (sensor type, such as ion, photo, combination;
- Power source (AC only, AC with battery, battery only, seal and replaceable batteries);
- Manufacture date;
- Interconnected or single station;
- Location within home:
- Whether the alarm or battery was replaced during the visit.



# Survey Topics

## 8. Alarms and Detectors:

- Homeowner knowledge of location;
- If no CO alarm:
  - Reason(s) for not having CO alarm;
- Number of alarms purchased after contact.

## 9. Household Demographics:

- Age;
- Disabilities;
- Smokers;
- Race and Ethnicity;
- Education;
- Income level.



**Questions?**





# RESEARCH FOUNDATION

## RESEARCH FOR THE NFPA MISSION

Workshop for Survey on Usage and Functionality of Smoke Alarms and CO Alarms in Households

16 February 2017

**Location:** Consumer Product Safety Commission  
4330 East West Hwy #400  
Bethesda, MD 20814

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