Testimony of the Department of Buildings
New York City Council
Committee on Housing and Buildings
Intro 773
October 24, 2013

Good afternoon Chairman Dilan, and members of the Committee. I am Gina Bocra, Chief Sustainability Officer, and have with me, Donald Ranshte, Director of Intergovernmental Affairs and Executive Analytics for the Department of Buildings. Thank you for allowing me the opportunity to testify on this legislation, which would create a registration of certain licensees of the Department as "eco-friendly".

This bill will amend the administrative code of the city of New York by adding Article 421 to Chapter 4 of Title 28, Eco-Friendly Plumber Registration. On its surface, we find the legislation to be problematic, and we are uncertain as to its intended scope. Moreover, the goals of this bill are already being addressed through the Department's ongoing Sustainable Contractor Designation Program.

This bill requires the Department to set forth standards for plumbers that are "eco-friendly," a term that does not appear to be defined with any industry or national standards. Also in section 28-421.1, we are troubled by the undefined term "progressive understanding".

We are thankful for the opportunity to discuss a Department initiative, which we believe currently addresses some of the issues identified by this legislation. The Sustainable Contractor Designation Program is a recent Department initiative that recognize those individuals who are working to meet today's increased demand for new, green technologies and reduce the City's carbon footprint. The program identifies contractors who demonstrate knowledge in sustainable practices through accredited third-party certifications, or credential programs. Contractors who choose to participate in the program agree to promote the use of green technologies to their customers and report these activities to the Department. Additionally, the program allows consumers to search for and identify contractors with expertise in green practices. Currently General Contractors, Master and Special Electricians, and Master Plumbers can participate in the program.

How does one currently become a Sustainable Contractor? To apply for Sustainable Contractor Designation, you must have an electronic copy of your certificate(s) ready to upload to the Department and have an efiling account with the Department. To obtain Sustainable Contractor Designation, you must have one of the following active license(s)/registration(s): General Contractor Registration (1-, 2- or 3-family home); Master/Special Electrician; or Master Plumber; and have current insurance information. Finally, to obtain Sustainable Contractor Designation as a plumber, you must have at least one certification(s) or credential(s) from one of the following accredited organizations: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Green Advantage, North American Board of Certified

Energy Practitioners (NABCEP), Passive House Institute US, U.S. Green Building Council and Urban Green Council, USGBC NY. Once all of these criteria are met, the designation is posted on our internet site under the license number of the designee.

At this time the Department believes that continuing to develop our current Sustainable Contractor Designation Program, rather creating a new regulatory scheme setting forth new standards for "Eco-friendly" Registrations, is the best way to achieve the bill's stated goals. We note that if there are additional third party organizations, such as the one mentioned in the bill, that wish to be a part of this program, we are open to accepting them.

Thank you for the opportunity to submit this testimony on Int. No.733. I would be happy to answer any questions you may have.

FOR THE RECORD

INTERNATIONAL CODE COUNCIL®

International Code Council
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www.iccsafe.org

Chairman Dilan, Members and Staff of the City Council Committee on Housing and Buildings, I would like to offer the following testimony in opposition to Int. No. 773, which would amend the administrative code of the City of New York, in relations to eco-friendly plumbers.

My name is Dorothy Harris. I am the Vice President of State & Local Government Relations and your liaison to the International Code Council. The International Code Council (ICC), a member-focused association dedicated to helping the building safety community and the construction industry provide safe and sustainable construction through the development of codes and standards used in the design, build and compliance process. Most U.S. communities and many global markets choose the International Codes. The mission of the ICC is to provide the highest quality codes, standards, products, and services for all concerned with the safety and performance of the built environment.

The Department of Buildings (DOB) is the City Department responsible for the enforcement and administration of the Construction Codes of the City of New York by performing plan examinations, issuing construction permits, inspecting properties, and licensing trades. The DOB already has a program in place which addresses the intent of this legislation. The program is called the Sustainable Contractor Designation Program. However, this program is not limited to merely one trade as is found in Int. No. 773, but instead encourage "eco-friendly" or "sustainable" building and installation by encompassing all areas of construction like: General Contractors, Master Plumbers as well as Master and Special Electricians.

The DOB Commissioner and Staff have the technical expertise to determine appropriate competencies and qualifications, consequently, any such qualifications should be determined by DOB; hence no specific listing should be named in the legislation. Therefore, it is our recommendation that in §28-421.1 Eco-friendly plumber registration of the bill the following sentence should be stricken ~~*and may include those adopted by the International Association for Plumbing and Mechanical Operators.*~~

Thank you for the opportunity to submit this testimony in opposition of Int. No.733. Please do not hesitate to contact me, if you would like any additional information or additional documentation.

3901 Liberty Street Road • Aurora, Illinois 60504-8122
Telephone: 630.851.7330 • Fax: 630.851.9309

October 22, 2013

Council Member Elizabeth Crowley
6477 Dry Harbor Rd.
Middle Village, NY 11379

To the Honorable Council Member Crowley:

We at First Alert/BRK Brands, the leading manufacturer of smoke and carbon monoxide alarms, applaud City of New York lawmakers for their efforts to promote consumer safety via legislation. As a wholly owned subsidiary of Rye, N.Y.-based Jarden Corporation, protecting your constituents is an even more personal cause for us. As such, we have partnered in safety and awareness with the New York City Fire Department for more than 20 years. Our organization – both independently and in conjunction with associations of which we are members – supports legislation that broadens access to important life-safety devices and provides for key safety requirements.

We are writing to express our support for Introductory Law No. 1111. Mandating replacement of smoke alarms once they have reached the end of their useful life will help protect New Yorkers from the threat of smoke and fire. Further, the requirement that smoke alarms installed after the effective date of the bill (if passed) feature a non-removable, non-replaceable battery will help reduce instances where a smoke alarm may be present but not feature a working battery.

As you review and discuss this bill, we strongly urge you to consider some possible interpretations and suggest clarifying language.

Specifically, we urge you to consider exempting wirelessly interconnected alarms from the requirement that they feature a non-removable, non-replaceable battery capable of powering the device for a minimum of 10 years. Wirelessly interconnected alarms require more power due to the wireless connectivity capability and, therefore, cannot meet the 10-year battery requirement. These wirelessly interconnected products provide the consumer potentially enhanced levels of safety thanks to the interconnection and should not be withheld due to the technical power consumption of this feature.

As a market example, lawmakers in California proposed solutions to ensure successful implementation of a law with similar goals to those of Introductory Law No. 1111. An example of such exemptions from California Senate Bill 1394:

> EXCEPTIONS:
> *(a) Smoke alarms that use low-power radio frequency wireless communication signal for interconnection.*[1]

Further clarification exempting hard-wired smoke alarms from the law would be beneficial as well, perhaps by adding that the language of the bill applies only to alarms solely powered by battery operation.

Finally, we highly recommend granting New York City retailers more than 120 days to comply with the ordinance. It puts small and large businesses in an equally difficult position from an inventory, display and associate education standpoint. Language such as that included in a recently enacted California bill would be beneficial:

EXCEPTION: This section shall not apply to any smoke alarm or combination smoke alarm that has been ordered by, or are in the inventory of, an owner, managing agent, contractor, wholesaler, or retailer on or before [APPROPRIATE DATES].[1]

To truly achieve our collective objectives, it is essential that smoke alarms and other safety devices be readily available with various features, such as the sealed, 10-year batteries and alarms with wireless connectivity.

We urge you to take these points into consideration as you review Int. No. 1111 proposed in the New York City Council, and we are available to further discuss this matter at your convenience.

Very sincerely yours,

Deborah Hanson
Director of Legislative Affairs
First Alert/BRK Brands

Mark Devine
Senior Vice President, Marketing
First Alert/BRK Brands

[1]TITLE 19 PUBLIC SAFETY, DIVISION 1. STATE FIRE MARSHAL, CHAPTER 1.5 CONSTRUCTION MATERIALS AND EQUIPMENT LISTINGS

October 24, 2013

New York City Council
Committee on Housing & Buildings
250 Broadway, Suite 1765
New York, NT 10007

Mrs Valerie Rivett
Photoelectric Smoke Alarm Advocate
Auburn, New York


Averyana

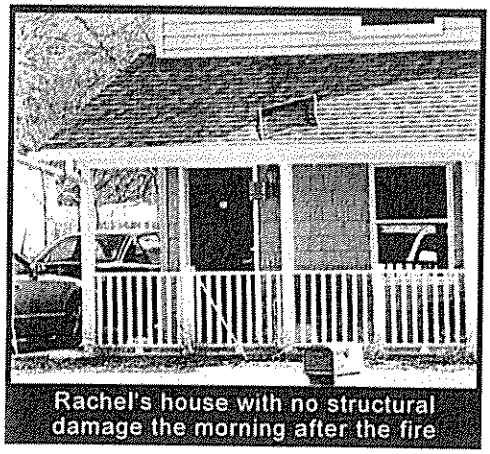
My Testimony to the NYCC Housing & Buildings Committees Residential Photoelectric Smoke Alarm Legislation Hearing - Oct 24, 2013

March 10, 2012. It was a Saturday night approximately 11:00 pm. My 22 year old daughter Brittany and I were playing on our new iPhones. As we scrolled through the apps, she came across a local police/fire scanner and decided we should download it and listen to what was going on around the city. The call that we heard come in would change our lives forever. The address was 62 Greenview Circle in Auburn New York. Immediately Brittany and I looked at each other and knew this was Rachel Harris-Curione's house. Rachel was my younger sister Natalie's best friend and Godmother to her two year old daughter Averyana. Occasionally, Rachel would have Averyana stay at her home for an overnight as she was like a second mother to Averyana.

As the second call was coming through, I called my sister Natalie and asked her if Averyana was at Rachel's. She said "Yes." I told her the fire trucks were going to Rachel's and to get there as quickly as possible and that I would call 911 to let them know that Averyana was also in the apartment and they needed to rescue her. As I ran to get dressed, Natalie called back and she was screaming like I have never heard before; the only thing I could make out was the word, "hospital." I jumped in the car and headed for the hospital praying to God that everything would be okay. As I jumped out of my car and ran for the Emergency Room doors, an ambulance pulled up with Averyana. The crew was performing CPR on her as they were wheeling her in. I immediately knew it wasn't looking good, but continued to pray for a miracle. Family members from both Rachel's and my family began pouring in to the emergency waiting room. We were crying hysterically. It was about 15 minutes after they brought Averyana in that we could hear a young child crying, immediately we all thought it was Averyana. We started thanking God for answering our prayers. However, the cry was not Averyana - it was another child.

Soon after, a doctor came out and said he was so sorry he couldn't save them. They were gone. My sister Natalie and my mom, along with many others, collapsed on the floor. I'll remember their piercing screams for the rest of my life. Soon after the families were allowed to go in and see both Rachel and Averyana. My sister Natalie rocked Averyana's body singing, 'Hush Little Baby Don't say a Word'. This was the last time she would ever hold Averyana and sing to her.

The next day on Monday, March the 12th, I went to Rachel's apartment. I wanted answers; we needed to know what had happened. I was nervous going there thinking how could I bare the pain of looking at the burnt out apartment? However, as you will see below, this was not the case. Rachel's apartment had no visible structural damage to indicate two young people had just lost their lives in a fire. As I walked up to the apartment I noticed the door was open so I went in. There was no structural damage inside either, just thick black soot. As I looked down by the front door I could see an outline in the soot where Rachel and Averyana had perished. It was clear they had tried to escape the fire but couldn't. They were only inches from the front door. The house was newly built and was equipped with hard-wired smoke alarms. So why didn't they get out? I was in total shock, why had they died when Rachel had brand new smoke alarms?


Rachel's house with no structural damage the morning after the fire

I started questioning our local fire chief, our fire department firefighters and the detectives. They all responded with much the same answer, "It was accidental and such a tragedy." They said they'd had several firemen including a deputy fire chief from Boston call them asking the same question, "Why hadn't they escaped?" I immediately called Boston fire departments looking for the deputy fire chief that contacted our Fire Department. I finally managed to track down Chief Jay Fleming. After speaking for a long time he asked, "What type of smoke alarms were in Rachel's apartment?" I said, "I'm not sure what you mean, isn't there just

one type of smoke alarm?" Her apartment was new and the firemen said she had battery back-up, hard-wired alarms. How much safer could you be than if you had brand new, hard-wired smoke alarms?

However, Chief Fleming told me there are two completely different smoke alarm technologies, ionization and photoelectric. I started researching smoke alarms extensively. I was amazed when I found out that in the states of Massachusetts and Vermont, that both border New York, photoelectric smoke alarms have been mandatory for years. They have been actively promoted in Boston for over a decade and Boston has the lowest fire death rate in the U.S. As a mother and citizen I find it extremely hard to comprehend why New Yorkers have been told next to nothing about photoelectric smoke alarms.

What was the most stunning revelation of all was the Hackert v First Alert law suit here in New York. In 2008, more than three years before Averyana died, federal court judges declared the failure of the ionization smoke alarms in the Hackert's home was a legal cause of deaths and that the ionization alarms were defective under New York law. I have been working with campaigners across America and from Australia who have been fighting to expose the defects of ionization smoke alarms for decades.

Almost all you ever hear from authorities is to make sure you have a working smoke alarm. I knew that I had to get the message out about photoelectric smoke alarms so that others do not have to suffer the ongoing pain and anguish my family suffers every day. That's why I started the campaign for Averyana's Law.

New York's proposed 'Averyana's Law' is state-wide photoelectric legislation that states:

> *"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."***

Averyana and Rachel died in an apartment fitted with new, hard-wired ionization alarms. CBS and others say ionization smoke alarms are deadly. One of the main problems with them is they are unable to safely detect visible smoke. From my research I learned that ionization alarms can be sometimes 30-50 minutes slower to sound than photoelectric alarms in the early, smoldering stage of a fire and sometimes they may fail to sound at all.

This information is known to the authorities who have kept the truth from the public and firefighters for decades. From the Mercer v BRK case (1998) it is clear that failing to warn the public of the known defects with ionization alarms is a crime. I am certainly not a legal expert. However, I am a Mother and I do know right from wrong.

Many firefighters have told me they are embarrassed when they find out about ionization alarms. They've been handing them out in good faith for years believing they will do the job they are meant to do - to give early warning to allow people time to safely escape. You have a Bill before you requiring photoelectric smoke alarms. Please don't jeopardize lives in your city by requiring any form of ionization technology. I believe doing so is a compromise and will cost more lives. I know first hand they are unreliable and have far too many problems.

Tonight some of you will tuck your loved ones in and kiss them goodnight.You will tell them you love them and turn out the light and you will go to sleep thinking you will see them in the morning. Most New Yorkers think they're safe; and yet their homes, just like Rachel's, are almost all fitted with ionization smoke alarms.

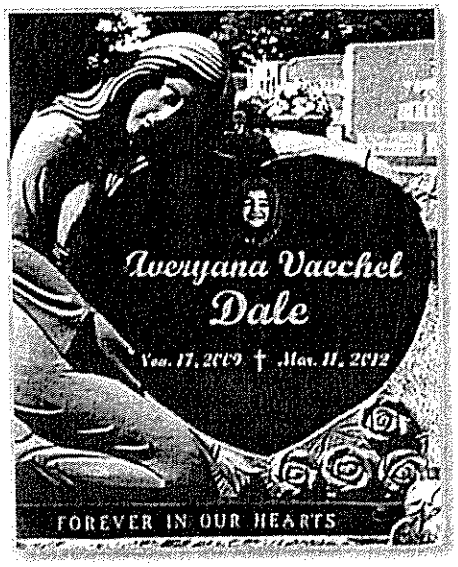
On March 10, 2012 my sister Natalie called Averyana on the phone and said, "Good night, I love you and I'll see you in the morning."

A parent's worst nightmare became a reality for my sister. Instead of taking my niece home, Natalie has had to pick a plot, buy a headstone and a casket and find the prettiest dress ever to bury our precious Averyana in.

For legal reasons no one wants to admit ionization alarms are unsafe. I want to congratulate you on your proposed photoelectric legislation, because it's not about saving face - it is all about saving lives.

Thank you.

Mrs Valerie Rivett
Photoelectric Smoke Alarm Advocate
Auburn, New York



For more Information please visit: AveryanasLaw.org

SAFE KIDS NEW YORK | SAFE KIDS NEW YORK CITY– MANHATTAN, BRONX, STATEN ISLAND | SAFE KIDS QUEENS | SAFE KIDS WORLDWIDE™

October 16, 2013

The Honorable Erik Martin Dilan
Housing and Buildings Committee, Chairman
New York City Council
250 Broadway, Suite 1763
New York, NY 10007

Dear Chairman Dilan:

On behalf of Safe Kids Manhattan, Safe Kids Queens and Safe Kids Worldwide, we write in favor of Bill 1111-2013, the legislation you have sponsored requiring owners of residential dwellings to replace their smoke alarms with alarms which last for ten years based on a non-removable, non-replaceable long-life battery. We applaud you for your leadership in introducing it. The development of the new smoke alarms will make homes safer for all New Yorkers, especially children and seniors who are especially vulnerable to fire injury.

Fires and burns are the leading cause of unintentional injury-related death among children ages 5 to 15, and 52% of all child fire deaths involve those 4 and younger. The best method to reduce home fire fatalities is the installation of working smoke alarms to provide early detection. In fact, the National Fire Protection Association (NFPA) reports that nearly two-thirds of home fire deaths result from fire in properties without smoke alarms or without working alarms, mainly due to dead or missing batteries.

The tragedy of the Balbuena family is just one example of the consequences of a home without an operable smoke alarm. In a 7th floor apartment in the Chelsea neighborhood five members of the family, three girls, a ten-year-old boy and their mother and father, died in a fierce fire which took more than 80 firefighters to put it out. Two of the girls were found huddled in a bathtub with their mother, who had broken the windows in an effort to survive. The girls were Nanny Joa (8-years-old), Bet-el Joe (3-years-old) and Ruth Joa (15-months-old); the son was Gonzan Joa (10-years-old). There were reports that Gonzan Joa, who survived the fire for a few days, may have been playing with matches or a lighter and had started the fire.

Fire officials said that a hard-wired smoke detector in the apartment was installed in the logical place for the apartment, but was purposely disabled, its wires pulled out and the back-up battery missing. It had melted down in the severe fire and was hanging from the ceiling. Fire Deputy Chief James Daly said that a working smoke alarm may have made the difference because, "Every second counts in a fire."

The reality is that many consumers have non-working smoke alarms in their homes and often do not replace the batteries in their smoke alarms. A 2012 survey by Kelton Research of U.S. homeowners revealed:

- 58% didn't know that batteries should be changed every six months;
- 68% believe that the need to replace batteries should happen less often;
- 61% of respondents say they allowed their alarm to be inoperable because of a non-working battery.

The best solution is to reform New York City's law to require smoke alarms with the capacity to contain sealed-in, long-life batteries. These alarms offer continuous protection for the life of the alarm without the worry of a battery dying. In addition, they save money in the long term. A ten-year smoke alarm may cost a little more upfront, but the consumer recovers this cost within a few years as they will not have to replace the batteries twice a year as required with a traditional battery, backed-up smoke alarm, leading to a total savings of around $30 to $60 over the life of the new alarm. City Councils in Milwaukee, Madison and Philadelphia have already passed similar laws.

If you have any questions feel free to contact Anthony Green at 202.662.0606 or agreen@safekids.org.

Sincerely,

Rosemarie Ennis
Director
Safe Kids New York

Anthony Green
Director, Public Policy
Safe Kids Worldwide

Joan Bush
Director
Safe Kids Queens

National Electrical Manufacturers Association

The Association of Electrical Equipment
and Medical Imaging Manufacturers
www.nema.org

Council Member Erik Dilan
New York City Council
250 Broadway
New York, NY 10007

October 23, 2013

Mr. Dilan,

On behalf of the National Electrical Manufacturers Association (NEMA) Signaling, Protection and Communication Section, I am writing to express concerns regarding Int. No. 865, a local law that would require smoke detectors installed on or after January 1, 2013 in certain occupancy groups to be photoelectric.

NEMA member companies produce smoke alarms and detectors employing a wide variety of fire detection technologies that have been tested to meet standards adopted by nationally recognized life safety standard-setting bodies. NEMA member companies, along with the Fire Protection Research Foundation and Underwriters Laboratories, continue to conduct research and amend consensus standards to confront the new home furnishings typically used in today's dwellings. The results of the research have led to new detection technologies and added new performance requirements to consensus product standards designed to enhance the early detection of slow-burning fires and fast-burning fires while improving the nuisance alarm immunity. For example, the 2010 edition of the National Fire Alarm and Signaling Code, NFPA 72, added spacing requirements for smoke alarms in relation to fixed cooking appliances to address a need for enhanced performance and reduction of unwanted alarms[1].

While the life safety goals of Int. No. 865 are well-intended, the measure could have the inadvertent consequence of eliminating future consumer choice in installing smoke detection technology that may provide advanced protection for consumers and their families. The U.S. Consumer Product Safety Commission (CPSC), the U.S. Fire Administration, NFPA, the International Association of Fire Chiefs, and the National Association of State Fire Marshals all endorse the life-saving benefits of smoke detection and have acknowledged that both ionization and photoelectric technologies provide available safe egress time. These organizations also cite the use of both technologies to maximize protection.

NEMA recommends that the local law be amended to allow other investigated and listed single or multi-criteria smoke detection devices. For your consideration, we recommend replacing the references requiring that the smoke detectors "...shall be of the photoelectric type," with the following language:

> shall be single detection technology or multi-criteria technology listed by a nationally recognized testing laboratory (NRTL) to the applicable American

[1] This provision also appears in the 2012 and 2013 editions of NFPA 72 at Section 29.8.3.4

National Standards Institute (ANSI)/Underwriters Laboratories (UL) product standards and installed according to National Fire Protection Association (NFPA) standards.

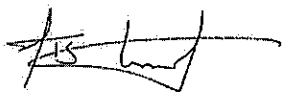
Approved (or 'listed') technologies have been properly installed, tested and maintained in conformity with national consensus standards. These standards are developed by industry experts, end users, code officials, and other interested stakeholders in a recognized, peer-reviewed process after full consideration of all material aspects of a given technology product class have been shown to save lives. Accordingly, adoption of this recommended amendment would assure that advancements in smoke detection technology are not precluded by New York City statute or code.

NEMA commends you for your attention to life safety and stands ready to work with you to advance this goal in a manner that protects future advancements in smoke detection technology. Please consider our industry as your best resource for fire and life safety product information. We are available at any time to consult with you on matters of life safety.

NEMA is the leading trade association of choice for the electrical and medical imaging equipment manufacturing industry. Founded in 1926 and headquartered near Washington, D.C., NEMA's approximately 430 member companies manufacture products used in the generation, transmission and distribution, control, and end-use of electricity. These products are used in utility, medical imaging, industrial, commercial, institutional, and residential applications and include life safety devices such as smoke detectors.

If you have any questions regarding NEMA's concerns about Int. No. 865, please contact Jonathan Stewart at (703) 841-3245 or via email at jonathan.stewart@nema.org.

Respectfully,



Jonathan Stewart
Manager, Government Relations

FOR THE RECORD

Re File #: Int 1111-2013

Title: A Local Law to amend the administrative code of the city of New York and the New York city building code, in relation to smoke alarms.

Expert Testimony
Richard H. Cantor, CPP
New York Electronic Security Association, President
New York State Licensed Fire Alarm Instructor

Bill Int. 1111-2013 is deeply flawed and unworkable in addition to which it will completely fail to accomplish the purported purposes for which it was drafted. There is nothing in this bill which is based on the National Fire Code (NFPA 72), Factory Mutual (FM), Underwriters Laboratories (UL) or any other recognized independent laboratory.

It completely fails to address any of the scientific and engineering parameters necessary to provide adequate early warning fire detection in residential housing units. It fails to identify the most suitable smoke detection technology. It fails to put forth a reasonable solution to the common problem of human behavior because it fails to address the reason people disable current detectors, which are exactly the same reasons they will disable any detectors regardless of their battery life if they continually false alarm. And the bill places a completely unreasonable and unworkable burden on tenants to be knowledgeable of the requirement to replace detectors and to be able to do so regardless of their ages or disabilities. Furthermore, the bill makes no provision for the fact that by the time the proposed 10 year time period expires, superior smoke detection technology might be available but would be prohibited from use by the wording of this bill.

From the point of view of professional fire protection engineering, there is nothing in this bill which would promote better fire protection. If the causes of false alarms are not adequately addressed, those persons who currently remove the batteries from today's smoke detectors when they go off will, in the future, remove the entire detectors when they false alarm. So the situation in all likelihood would be worse than it is today.

The only thing this bill would accomplish is that it would be a tremendous boondoggle for manufacturers because it would require the unnecessary purchase of hundreds of thousands of new smoke detectors, many of which incidentally would be inferior to current detectors already installed.

Therefore, the potential passage of this bill relies on the Council members not having an in-depth knowledge of fire detection technology and being presented with language in the bill that falsely implies (via reference to UL 217) that the changes are referenced in the Standard which they are not.

An entire new array of problems would emanate from this bill in those cases where combination smoke/carbon monoxide (CO) detectors were required to have 10 year batteries. CO detectors will only remain effective for 3 to 5 years with current

technology, so either this bill would have to prohibit combination detectors or be redrafted to accommodate the shorter lifespan of CO detectors.

In summary, the changes proposed by this bill are unnecessarily costly, they would undermine improvements in fire safety, they would be unworkable, and they would be unenforceable. The requirements it mandates would be of benefit only to smoke detector manufacturers who would make a windfall, while doing nothing to improve residential fire safety.

Re: file #: Int 0865-2012

Title: A Local Law to amend the administrative code of the City of New York and the New York City building code, in relation to requiring photoelectric smoke detectors in residential buildings.

Expert Testimony

Richard H. Cantor, CPP
New York Electronic Security Association, President
New York State Licensed Fire Alarm Instructor

When the word "fire" is mentioned in reference to building structures, the visions it conjures up in most people's minds are of leaping flames depicted in Hollywood movies. But in the case of residential fires it is smoke and fumes which are the overwhelming killers, not the flames. Moreover, in most deadly residential fires, smoke and fumes precede heat and flames by enough time to make a significant difference in providing time to escape from fires. In other words, detectors which respond most rapidly to smoke and fumes are preferable by a significantly wide margin over detectors which are sensitive to flaming fires.

There is an extensive body of knowledge proving that certain types of detectors are inadequate to provide residential fire safety going back to testing by the U.S. Bureau of Standards in the 1970's. At that time the most prevalent type of home fire sensors were heat detectors. But today, heat detectors all come with the labeling: "WARNING: NOT A LIFE SAFETY DEVICE". That warning is not to imply that heat detectors are inappropriate in all fire detection applications, it is only to make clear that heat detectors are inappropriate for residential applications specifically because they are incapable of detecting smoke and fumes which are the predominant killers in home fires. In certain specific application heat detectors are the preferred method of fire detection. The same thing can be said of all other types of fire detection; each has its appropriate applications and its inappropriate applications.

For the purpose of this bill it is very important to focus on the differences in the two most prevalent types of residential smoke detectors in use today:

- the ionization type, and
- the photoelectric type.

Even though both types are referred to as "smoke" detectors and even though both types are UL listed for that purpose, only the photoelectric type actually detect smoke at its earliest indication, which is prior to the flaming stage of a fire. Ionization detectors are incapable of detecting smoke at this early stage and must wait until flames have broken out. This delay in detection often proves to be lethal.

Ionization detectors contain a small amount of Americium, a radio active isotope. Radiation from this isotope knocks electrons off atoms of air in its sensing chamber, setting up a small electrical current. When particles of combustion ("smoke") get into the chamber, they disrupt this electron flow, setting off the alarm. The trouble is that it takes extremely tiny, very high energy particles to disrupt this electron flow - particles that are only produced by flaming fires. Ionization detectors are incapable of detecting the relatively large, low energy molecules of smoke produced at the earliest stages of most deadly residential fires.

Modern photoelectric detectors on the other hand work by shining a light into a completely dark chamber with a photoreceptor blocked from seeing the light directly. However, when smoke particles get into the chamber they reflect the light beam which is detected by the photoreceptor causing an alarm. It makes no difference how small or large the smoke particles are nor how much energy they have. This enables photoelectric smoke detectors to provide much earlier detection of most residential fires.

In study after study, the above facts have been repeatedly demonstrated. Photoelectric smoke detectors are far superior to ionization detectors in detecting most residential fires at the earliest time and therefore provide the greatest time to escape.

But that is not the entire story. There is an equally important advantage of photoelectric smoke detectors over ionization smoke detectors in residential applications, and that is the fact that they are far less prone to false alarms. There are a myriad of things in the home which cause ionization detectors to false alarm but which cause far fewer false alarms with photoelectric detectors. Chief among these causes of false alarms for ionization detectors is cooking. Cooking produces an abundance of minute, high energy particles which are ideal for tripping ionization detectors but which are ignored by photoelectric detectors. The importance of this distinction cannot be overstated, because it is repeated false alarms which cause people to disable their detectors. And this fact is one of the primary reasons that bill File #: 1111-2013 is so misguided. Battery life has nothing to do with mitigating false alarms, and people will disable any detector which continually false alarms regardless of how it is powered. Without first addressing the false alarm issue battery life is a moot point.

From a purely engineering standpoint, photoelectric smoke detectors are far superior to ionization detectors. A properly calculated photoelectric smoke detector will continue to maintain its factory calibrated detection sensitivity indefinitely. On the other hand since the sensitivity of an ionization detector depends on the half live of the radio active isotope, it continues to deteriorate from the moment it is manufactured. At the end of several years an ionization detector is likely to be incapable of detecting fires at all.

In summary, by mandating the use of photoelectric smoke detectors this bill will do a great deal to save lives by providing the earliest warning of residential fires and by reducing the number of detectors which are intentionally disabled due to repeated false alarms. It merits the full support of the committee and passage by the City Council.

FOR THE RECORD

INFORMATION FOR J. MAILMAN

REGARDING THE IONIZATION TYPE SO-CALLED SMOKE DETECTOR

The intent of this report is to confirm that the ionization type so-called smoke detector is a fraud and that the marketing of the device has been a very deadly criminal operation. This marketing of a defective warning device was founded on blatant performance lies and it has caused tens of thousands of wrongful deaths. Children have especially been its victims.

As a fire protection engineer that has investigated the ionization detector fraud for decades, I have more than adequate evidence confirming that selling this so-called smoke detector can best be described as a racket conducted with the cooperation of organizations that have reputations of being "protectors" of the public. I include both Underwriters' Laboratories (UL) and the National Fire Protection Association (NFPA) in this category. This is one more case where money trumped human decency.

A small portion of the evidence of dishonesty that is available is attach as follows:

1. An extract from this web site **TheWorldFireSafetyFoundation.org** that includes a quote from Jay Fleming, a fire chief in Boston, wherein he claims that about 10,000 fire deaths since 1990 have been caused by the ionization device failing to respond to fires in a timely manner or not at all. But the fraud began during 1965 (at least) and I claim that the number of deaths of **children** (below teen age) exceeds 30,000.

2. A copy of one of the many false ads placed in the ***Fire Journal*** of the NFPA from 1965 into 1980. For approximately 16 years the makers and sellers of this false smoke detector promoted their devices with deliberate and fantastic performance lies. Note the ad claimed that the devices would sound **before smoke or flames appeared.**

3. Within my attached report, ***I Call it Murder,*** I have compiled a list of the many different ways that the makers of the **non-smoke** detectors deceived the fire chiefs with false performance claims over the 16 year span of false advertising within the NFPA publication. Note that over and over again the claim was made that the ionization device would warn "**before smoke or flames appear**". Because the ads ran within the NFPA publication and carried the UL label the fire chiefs across the nation began to believe the performance lies.

4. I also attach ***Dunes Tests Nos. 2 and 10.*** During the Dunes Tests of 1974, 75 and 76 seventy six fire tests were conducted. During the **smoldering** fire tests generally the ionization devices required more than an hour to respond to the conditions. Usually, only after the smoldering fire was near the point where flames appeared, or had already flamed, did the ionization device sound. I can also provide federal correspondence indicating that a smoldering fire can sometimes produce lethal levels of toxic gases within as little as 15 minutes.

So, within 15 minutes conditions created by a smoldering fire can begin to slowly kill a sleeping person whereas the alarm may sound perhaps an hour and a half later. Only when the fire is at or near the flaming stage will the device sound. That is the equivalent of a

passenger in the car shouting "watch out" when the car is already ten feet over the cliff with a thousand foot drop.

The ionization device does have some useful purposes, however. For example it can warn you that the toasting bread is overdone. Of course its best attribute is that it has enriched the makers by many billions of dollars, some of which presumably have been shared with the NFPA/UL cooperating team. So all those dead and horribly damaged kids were not completely without value; a great many who have been involved with the scam have benefitted greatly.

Many of the honest people who are concerned with kids burning so the bucks will flow are correctly warning that the ionization device is a non-warner of the smoldering fire. The con men that lied to the fire chiefs to sell the device are seizing upon this charge to justify the continued sales of their children killing devices. They are now saying, OK, this device is not the best for the smoldering fire; but let's continue to sell it for warning of the flaming fire. I will be more than willing to testify under oath about its inadequacies relative the flaming fire. This device is a fraud and a killer regardless of the fire type. Contrary to popular opinion, the flaming fire, not the smoldering type fire, is the more prolific killer.

R. M. Patton
Professional Engineer and Investigator
rmpatton7@gmail.com
October 22, 2013

I CALL IT MURDER

The marketing of a defective fire detection device, incorrectly called a "smoke" detector, with deliberately falsified performance claims has resulted in an estimated 75,000 wrongful fire deaths over nearly a five decade period. There is no doubt that the smoke detector fraud has been more deadly than all the serial killers of the 20th century combined. And, what is especially disturbing is that the very organizations that the public trusted to protect them were deeply involved in the fraud. All decent people must find it beyond comprehension how major business organizations would be willing to sacrifice tens of thousands of lives to profit from the marketing of a device which, when brand new with fresh battery, would fail to perform in accordance with the published performance claims just about one hundred percent of the time. What possessed these business leaders to lie so blatantly and deceive so many to make money selling a phony smoke detector?

FEDERAL APPEALS COURT CONFIRMS THAT THE DEVICE IS A KILLER

The United States Court of Appeals, Second Circuit (City of New York) in the case of Hackert vs. First Alert, Inc. and Standard Brands, Inc. (No. 06-4387-cv) dated, January1, 2008 held that the ionization type smoke detector was "**defectively designed**" and "**a legal cause of deaths**". As I will explain shortly, all ionization type smoke detectors are of similar design and all are not capable of detecting real (visible) smoke and frequently remain silent as deadly conditions develop in a home.

WHY THE DEVICE IS NOT A TRUE SMOKE DETECTOR

When the device was first introduced in the United States as a fire detector it was named a Product of Combustion (POC) detector, **not** a smoke detector. No doubt the manufacturers knew it would **not** detect smoke (visible combustion particulate). The device usually contains one microcurie of Americium 241. This is a radioactive material that emits 37,000 Alpha particles (nuclei of the Helium atom) every second. The Helium atom is the second smallest atom and as it knocks electrons off air molecules it creates an electric current across the detection chamber. When a particulate produced by a fire or otherwise (consisting of an incredibly large number of incredibly small particles - a billion or two per cubic inch will do) enters the detection chamber, the current flow created by the radioactive emissions will be reduced and an alarm sounds. But, particles small enough and numerous enough to interfere with the 37,000 helium nuclei being emitted each second are far below the visibility range of the human eye. **Visible** particulate (smoke) from combustion is made up of particles that are "mountain size" in comparison to the helium nuclei that must be affected to create an alarm. Hence, the general rule is if ***you*** can see smoke the ionization type smoke detector ***cannot*** see it. Sometimes a fire will deliver to the detector the billions upon billions of atomic sized particles that are required to cause an alarm to sound while also producing enough large (visible) particles. Then it **appears** that (visible) smoke is causing it to sound. Of course, when the manufacturers wanted to sell the device as a "smoke" detector, they used "the right kind" of demonstration fires to deceive the observers.

PERFORMANCE LIES THAT DECEIVED FIRE OFFICIALS AND THE PUBLIC AS THEY APPEARED WITHIN THE NFPA FIRE JOURNAL 1965-1981

Beginning during the mid-1960s and through 1981, advertisements appeared frequently within the NFPA *Fire Journal* claiming that the ionization device would react to all four designated "stages" of a fire from **Incipient** (chemical decomposition due to heat but no smoke or flames yet) through **Smoldering**, **Visible Flame** and finally the **High Heat** stage. Here are some of the direct quotes from some of these ads. Needless to say, all who were concerned with protecting lives in homes were impressed with the claims that the device would warn even before an actual fire developed.

PYR-A LARM (a subsidiary of Baker Industries); September 1965: "FASTEST Fire and Smoke Detection Available. Only PYR-A-LARM reacts immediately to the invisible products of combustion **before** there is visible smoke, heat or flame."

BRK Electronics; July 1966: "Three minutes are worth a dozen fire engines. The BRK Electronic Fire Detector gives an alarm MINUTES, HOURS; even DAYS earlier . . . Before there is smoke, before there is fire . . . the BRK fire detector picks up invisible gases of combustion and triggers an alarm . . . And it does it without using radioactive material." (*Actually the device did contain radioactive material.*)

BRK Electronics, Inc.; July,1967: "I smell smoke. (Picture of bloodhound wearing fire chief hat) The BRK fire detector senses the invisible products of combustion that precedes actual fire and smoke."

Kidde; November, 1968: "Is a little smoke any cause for alarm? You bet your business it is. Because a little smoke means a little fire. And we all know little fires grow big, fast as blazes. Well, Kidde makes a device

that smells smoke and yells fire long before anything gets hot. (Even when the smoke is invisible.)"

Firemark (Division of Rixson, Inc.); March, 1969: "**before visible smoke or fire - - - FIREMARK'S** new FM-1600 Ionization Fire Detector will sense products of combustion and instantly respond."

Honeywell Automation; July, 1969: "Honeywell engineers break the pattern. New, low-voltage, ionization fire detector senses combustion before the smoke appears. It senses products of combustion so small they're invisible. Those you can't even smell. That's why UL listed it at *all* levels of sensitivity."

Fire Lite, Kidde, Bliss Gamewell, Faraday, Simplex, The Autocall Company, and Unelco Limited; July 1969: "FIGHT FIRE . . . the easy way . . . before it starts! Fire Alert Ionization SMOKE DETECTORS – for Positive, Early Sensing of FIRE in its Incipient Stage."

SmokeGuard (Statitrol Corporation); May 1972: "COMFORTING (picture of baby with a blanket) but hardly a life saver. Remember your old security blanket? Personal Comforting. Statitrol has a brand new "security blanket" that helps protect your home and family against the dangers of fire. It's amazing how such a small addition to your home can give so much protection. Operating on the ionization principal, SmokeGuard senses danger – sounds a warning – gives you time to react – before you can even see or smell it."

Honeywell, The Automation Company; July 1972: "Here's an early warning system that lets you do something about fire . . . while there is still time on your side. The new detectors see "unseen" particles of combustion . . . in a fire's *incipient* stage. The stage when you can do something about it! . . . before smoke, flames and heat build up. Before sprinklers are activated. When this system sounds off, you can do something about it."

PYR-A-LARM (a subsidiary of Baker Industries); May 1973: "Pyr-A-Larm's reputation was developed through engineering and technology. We developed the original ionization detector."

Environment/One Corporation, (nev-r-fire detector); May, 1974: "It's not a pacemaker. But it's just as important to life – it's part of the Incipient Fire Detection System – the newest concept and major breakthrough giving the earliest warning of impending danger at the **INCIPIENT** stage of a fire. Early enough so action can be taken to save life and property."

BRK Electronics; September, 1974: "What a beautiful way to save lives! As smart as it looks, the electronics inside are even smarter. The ionization chamber and solid state circuitry are designed to detect products of combustion in all four stages of a fire – from the earliest (or incipient) stage to the smoke, flame and high heat stages."

PYR-A-LARM (A subsidiary of Baker Industries); May, 1976: "Working on the principal of ionization, the Guardian can sound the alarm before you can smell smoke or notice heat or flames."

Environment One; May, 1981: "Stop a fire before it's a fire. Space-age system warns of fires before they ignite. Most fire detectors warn too late – after they have begun to smoke, smolder or burn. But now the Incipient Fire Detector (IFD) from Environment/One can detect pre-ignition conditions as well as fires. (*The detector*) Alerts you when potentially flammable materials begin to overheat."

THE LIES THAT KILLED TEN THOUSAND CHILDREN

These are the lies that killed ten thousand children. And the lies caused injuries and maiming to at least 50 thousand additional children. But the full harm inflicted on society is beyond calculating. There have been lost parents, lost siblings, months long hospital stays, pain and sorrow beyond bearing, surgeries to somewhat repair destroyed faces, lost assets, lost incomes, lost homes, lost heirlooms, bankruptcies, humiliation and even suicides in the wake of the fire devastations. And what makes it most intolerable is that those we trusted to protect us betrayed us. Because the lies and the four decades of cover-up were so effective, honest and reliable fire detectors (that would have all but eliminated fire deaths) were fire code eliminated from service in the home.

THE "SMOKE" DETECTOR CANNOT WARN OF A SMOLDERING FIRE

When the manufacturers claimed that the device would sound an alarm **before** smoke or flames appeared, obviously the implication was that it would definitely be sounding when smoke finally did appear. Therefore, the ads (backed by the UL Label) were guaranteeing to the consumer that the device would warn early when a **smoldering** fire developed caused by a cigarette on bedding or in the crevice of a sofa. However, the failure rate of that "instantaneous" device was so high that by the early 1970s the

authorities knew that something was very wrong. So, beginning in 1974 a government funded test program called the Dunes Tests was initiated. These tests, employing real fires in real homes, were intended to evaluate the performances of fire detectors including the ionization device. During Phase 1 of the Dunes Tests (40 live fire tests) there were 18 tests involving **smoldering** type fires. The smoldering fires created potentially deadly levels of smoke and toxic gases but virtually no heat. During Phase 1 there were 162 opportunities for installed ionization type smoke detectors to detect these potentially deadly fires as advertised. Zero ionization detectors sounded inside five minutes, one sounded within 10 minutes and only 28 operated within 30 minutes (**an 83 percent failure rate if failure to detect a smoky fire within a half hour would be considered a failure**). However, during the two phases of the Dunes Tests (76 fire tests during 1974-1976) three of the four test engineers were employees of UL. Of course, after about ten years of selling the defective device with a UL "certification", the publicising of these facts probably would have resulted in legal actions for wrongful deaths against UL. The true results of the tests program were concealed. At night, when all are asleep, a smoldering type fire can gradually create a deadly environment of thick visible (blinding) smoke and toxic gases, some of which are even deadlier than CO in lesser concentrations. It is the toxic gases, not smoke, that kills. But smoke can trap the victims and the combustion gases will kill.

THE DEVICE IS NOT SATISFACTORY PROTECTION FOR FLAMING FIRES

The ionization type so called smoke detector **is** capable of detecting the invisible, near atomic sized combustion particles produced by a **hot flaming fire**. But is it a **reliable** detector of the flaming fire? The answer is . . . **NO!** The fire that is flaming from the start will often doubles in size every minute. Black smoke at ten times the temperature of boiling water can be making the exit paths untenable in less than five minutes. A fast and reliable warning device is essential if life is to be saved in a home. On December 1, 1958 a fire occurred within the Lady of Angels School in Chicago. Thick smoke blocked the exits so fast that many young children and their teachers were trapped within their classrooms. Before the firefighters could rescue them 95 perished. Following that fire the Los Angeles Fire Department ran live fire tests in a real (retired) school to determine what level of smoke (light reduction per foot) would prevent travel through it to safety. The conclusion was that **when smoke rose above 4 percent** (40 percent reduction in visibility in ten feet, 80 percent in 20 feet) **the exit path would be considered unsafe to travel**. So, when testing the so called ionization device at UL **the smoke is allowed to go as high as 37 percent** (nine times the recommended limit) while passing the tests. Then the manufacturer may imprint the UL Logo on the device which will convince the consumer that it will save the kids when a fire occurs in the home. As previously stated, my calculations based on NFPA and federal loss data indicates that at least ten thousand dead children proved that logo wrong.

FIRE IS A BUSINESS MOST PROFITABLE

Fire generates more than two hundred billion dollars a year in sales and government expenditures. Fire is a business. The businesses that profit from fire need fires just as surely as the oil business needs automobiles. The two regulatory organizations that control the entry to the fire marketplace have been in control of the market for more than a hundred years. Both the NFPA and UL survive as controllers of the marketplace because organizations that profit from or otherwise benefit from fire support them. The two hundred and more fire codes that are enforced by the local and state fire officials are written by Code Committees of the NFPA. In turn, these committees predominantly consist of voting representatives from the very organizations that benefit from fire. The codes serve the organizations that write the codes, not necessarily the people. That is why a phony smoke detector replaced honest fire detectors that were in the code when the ionization device was first promoted. Also, that is why the fire sprinkler industry has been able to create NFPA codes that overprice fire sprinkler systems by up to ten times causing most buildings to be built devoid of sprinklers.. That is why the half hour and one hour fire rated compartments in nursing homes, apartment houses and motels often fail to contain the initial "one compartment" fire for even the five or ten minutes prior to the arrival of the firefighters. That is why high rise elevators are taken out of service, often condemning those trapped on upper floors to die, when a lower floor is burning. Rather than designing elevators to be safe exiting systems, the industry has avoided responsibility and potential liability by removing them from service when the building is burning. It is money, not humanity, that influences the testing at UL; and the writing of the

NFPA codes that takes place in the four star hotels in distant cities.

PUBLIC DENIED REAL FIRE SAFETY

There are two solutions to fire that would reduce fire deaths by at least 90 percent. The reality is that when a family becomes aware of a fire in the home almost as soon as it initiates there is time to promptly extinguish it or to leave safely. Fire deaths occur because a **flaming** fire is allowed to grow large and deadly or a **smoldering** fire is allowed to create a toxic environment **BEFORE** discovery or warning. The NFPA/UL administrations have had a hundred years of free rein for controlling the multi-billion dollar fire marketplace. This control of a multi-billion dollar market place ended up as a bonanza for the profiteers of fire and a total disaster for the public.Fire testing and rigged fire codes have prevented the marketing of properly engineered low cost-available water sprinkler systems for homes. Such systems could perform well with the 5 to 15 gpm usually available in a home. But tests were rigged and falsified to impose a 40 gpm, impossible to achieve economically, criteria for home systems. (That, however, is another story.) **With available and reliable fire detectors an early warning of a house fire would be a 99.9 percent guarantee rather than a perhaps 17 percent guarantee with the present phony "smoke" detectors**. Proper protection will be a **photoelectric type (real) smoke detector f**or **smoldering** fires and **heat detectors** for **flaming** fires. But the NFPA/UL market control system has prevented the marketing of the superior protection systems.

THE SMOKE DETECTOR FRAUD WAS ORGANIZATIONAL MURDER

The marketing of the ionization device was originally promoted with the false claim that it would warn of fire, **smoldering** or **flaming**, **"before smoke or flames appeared"** In time most fire department officials throughout the nation believed the lies. They began to promote the device and even petitioned the legislatures to adopt the NFPA code that was mandating the sale of the device. By 1974 when the Dunes Tests were run the fire chiefs were locked into the ionization type smoke detector as being the "essential" safety device in the home. After the Dunes Tests were run during 1974, which confirmed that the device was close to useless, the engineers in charge falsified the test report to hide the truth. But many officials had witnessed the testing and the truth was known to many. When I received a copy of the report I did not proceed far before I realized the report was as phony as the device being tested. During 1976 I published and distributed my report, ***The Smoke Detector Fraud*** which revealed the corruption. But it was extremely difficult for one man to overcome the power of the regulatory system. From that time onward, despite my continued efforts to get the truth out, the NFPA/UL team with the cooperation corrupt fire bureaucrats within the National Institute of Standards and Technology (NIST), were able to keep a lid on the fraud. The greater the number of fire deaths due to the phony smoke detector, the greater the incentive to hide the truth. To my knowledge not one of the offending organizations (that submitted falsified performance advertisements to the NFPA) ever corrected their initial devious and fraudulent claims. Therefore, I believe that all involved committed crimes worthy of the designation of **criminal fraud- second degree murder**. See the web sites below for videos of recent **honest** fire tests and information confirming the seriousness of the fraud.

EVIL WINS WHEN GOOD PEOPLE DO NOTHING.
www.TheWorldFireSafetyFoundation.org • www.Firecrusade.com
www.AmericasHolocaust.org
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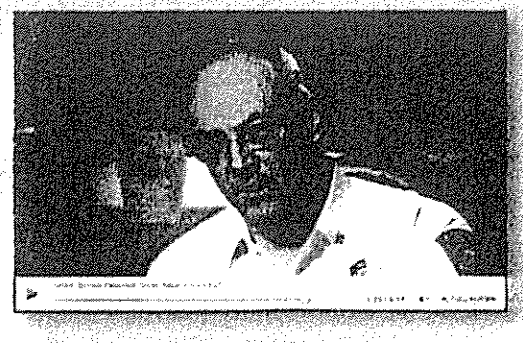


"I think the ionization alarm is responsible for as many as 10,000 deaths since 1990."

Chief Jay Fleming, Boston Fire Department
Massachussetts, USA, December, 2007

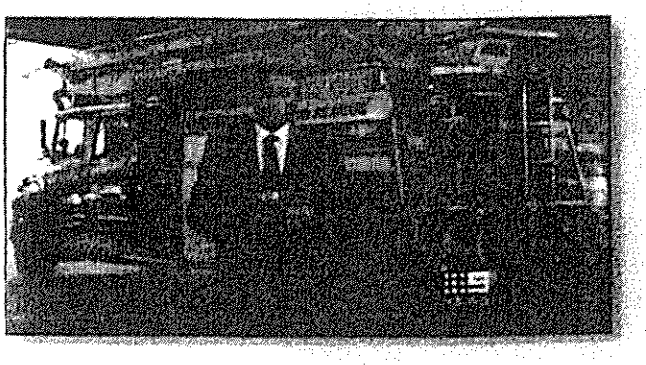
Deadly Smoke Detectors TV series:
www.theWFSF.org/cbs

"...the ionization alarms have failed* Australian Standards since 1993."

*Unable to pass the scientific tests for visible smoke

Darren Curtis, Senior Reporter
Channel 9 News QLD, Australia, May, 2011

Australia's Flawed Smoke Alarm Standard:
www.theWFSF.org/sa



THE PROLONGED AND DEADLY LIES

From 1965 until 1980 the various manufacturers of ionization type "smoke" detectors placed ads within the NFPA ***Fire Journal*** claiming the these devices would warn of a pre-fire condition before smoke or flames would appear. The claims were blatant lies.

FIRE JOURNAL JULY 1965

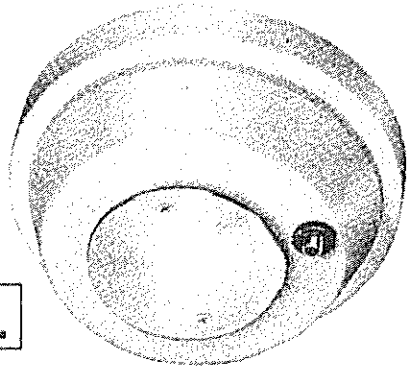
FIGHT FIRE

... the easy way ... before it starts!

FIRE ALERT Ionization SMOKE DETECTORS

-for Positive, Early Sensing of FIRE in its Incipient Stage.

- Exclusive Solid State integrater Circuitry
- Low Voltage Wiring - 24 Volts D C
- Supervision - Signals upon Line or Component Failure
- Versatile - Faster Response for smaller fires
- Adjustable Sensitivity Control



FIRE LITE ALARMS

Kidde

BLISS GAMEWELL

FARADAY

the Autocall Company

Simplex

UNELCO LIMITED

DUNES TESTS NOS. 2 AND 10

TYPICAL SMOLDERING FIRE TESTS

TESTS THAT PROVED THE IONIZATION DEVICE TO BE A FRAUD

SERIES 1, 1974

Beginning during 1965 and continuing into 1980 manufacturers of the ionization device advertised that their devices would warn of a fire within the home even before the smoke or flames could be seen. This fraudulent "fire science" held that when a combustible was being heated ions (charged atoms) would be emitted. These atomic sized particles would then spread rapidly throughout a home and reach the centrally located ionization device. Then an immediate alarm would sound even before smoke or flames appeared. Because the device was being "certified" by Underwriters' Laboratories (UL) the fire chiefs believed the performance lies. They began to promote the device. Years later, after live fire testing in real homes revealed the truth, the fire chiefs were reluctant to admit the truth because they were, by then, deeply involved in the fraud. Thus, for more than 4 decades a fraudulent so-called "smoke" detector has been sold into about 90 million homes.

To illustrate the degree of the deception by the manufacturers of the device, Test Nos. 10 and 2 of the Dunes Tests are analyzed here.

TEST No. 2

Test No 2 of that research program involved a smoldering type fire in a sofa in a living room of a real house. Nine ionization devices were installed within the home. A charcoal lighter was applied for a short time to initiate a smoldering type fire. The first smoke appeared at one minute after ignition. The first activation of an ionization device occurred at 43 minutes after ignition. That was 42 minutes after smoke appeared. One more ionization device operated at 1 hour and 13 minutes. At 1 hour and 32 minutes the engineers were obviously frustrated because the other seven ionization devices were not responding. So they altered the smoldering fire by placing a cloth over the char to initiate flaming. Flaming initiated at 1 hour and 43 minutes and finally all the ionization devices operated. The average time of sounding an alarm for all 9 ionization devices was 1 hour and 35 minutes. However, if the engineers had not "manipulated" the smoldering fire (the char) to cause it to heat up and finally flame, the test may have continued much longer before all of the detectors operated.

Despite overwhelming evidence confirming that the ionization device is defective and often the cause of fire deaths and injuries, as of December 2012 the device is still being marketed and the National Fire Protection Association (NFPA), Underwriters' Laboratories (UL), the Society of Fire Protection Engineers (SFPE) and the various federal agencies are still in the cover-up mode.

TEST No. 10

Test No. 10 involved a smoldering fire test with charcoal lighter ignition to a mattress in the basement of a home. This test was typical of the many fire tests involving smoldering fires. By citing this test I am illustrating a problem with the type of smoke detector that is installed within an estimated 90 million U.S. homes.

TEST NO. 10

THE TIMES OF OPERATION OF IONIZATION DEVICES

IONIZATION DET. NUMBER	TIME OF OPERATING minutes
3	79.8
5	did not operate
7	80.2
12	(149.9)
13	79.8
16	96.5
17	82.7
18	did not operate
19	did not operate

( ) Operated *after* the test was terminated at 2 hours and 22 minutes and while the basement was being ventilated.

Note: The first ionization device operated at approximately 1 hour 20 minutes. The last operating detector sounded at approximately 1 hour and 37 minutes. Four of the nine detectors failed to operate during the 2 hour and 22 minute test.

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Fire Science and Technology Inc.

VYTENIS BABRAUSKAS, Ph.D.

CURRICULUM VITAE
(revised 24 June 2013)

Education

Graduate

University of California, Berkeley, Ph.D., Fire Protection Engineering, 1976. Dr. Babrauskas was the first person ever to be awarded a Ph.D. degree in Fire Protection Engineering.

University of California, Berkeley, M.S., Structural Engineering, 1972.

Undergraduate

Swarthmore College, A.B., Physics, 1968. Also, concentration in electrical engineering.

Professional experience

1993 - present : Fire Science and Technology Inc., President. Dr. Babrauskas founded FSTI in 1993 as an organization devoted to fire safety research & development and for consulting on fire safety issues.

2002: Worcester Polytechnic Institute. Adjunct Full Professor, Spring Semester. Taught Special Topics—Ignition Phenomena in the Dept. of Fire Protection Engineering.

1998: University of British Columbia. Lecturer, Winter Session. Taught fire dynamics to Master's degree students in the Fire Protection Engineering program.

1977 - 1993 : National Institute of Standards and Technology (NIST), Center for Fire Research/BFRL, Fire Prevention Engineer (note that prior to 1988 NIST was called the U.S. National Bureau of Standards). At NIST, Dr. Babrauskas headed up various programs and research groups in the area of materials flammability, fire toxicity, test method development, upholstered furniture flammability, building code fire safety requirements, and fire resistance.

1973 - 1976 : U. of California, Fire Test Laboratories, Research Specialist. During his work at UCB, Dr. Babrauskas specialized in fire modeling, test furnace design and fundamental studies on fire endurance.

1969 - 1971 : U. S. Army Corps of Engineers, Philadelphia, Civil Engineer. Dr. Babrauskas designed roads, bridges, and waterworks for the Army Corps of Engineers.

1968 - 1969 : University of Pennsylvania, Assistant instructor, Physics department. Dr. Babrauskas taught laboratory courses to physics undergraduates at the University of Pennsylvania.

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Highlights of professional achievements

Dr. Babrauskas is a ranking international authority on the measurement of heat release from fires (which tries to answer the question, *How fast do things burn?*). In 1982 he developed the Furniture Calorimeter, which has become the medium-scale test method specified in various ASTM, NORDTEST, and Underwriters Laboratories standards. He then developed the primary method currently being used on a world-wide basis for bench-scale measurement of heat release rates. For the development of this instrument, the Cone Calorimeter, he was awarded the Department of Commerce Bronze medal in 1986. His invention was also recognized in his receiving the *R&D 100 Award* for it in 1988. The Cone Calorimeter is today considered the most important bench-scale tool for determining "how fast things burn." It is used in approximately 200 laboratories in over 30 countries. The Cone Calorimeter standards issued by ASTM, NFPA, and ISO have been based on his works.

In 1992, the textbook **Heat Release in Fires**, Babrauskas and Grayson, eds., was published. This major work reviews the entire state of the art of measuring and predicting the growth of fires, based on quantitative engineering methods and on the newest experimental techniques, many of which were developed by Dr. Babrauskas. This is the only available monograph on the subject today.

Dr. Babrauskas has contributed significantly to advancing the state of the art in quantifying the fire hazards associated with **toxicity**. He headed the research team developing the new radiant-heating test method for toxic potency, the first such to be based on effective full-scale validation with room fires. He also developed a methodology for consistently handling carbon monoxide in relation to toxicity contributions from other fire gases. The dominant role of carbon monoxide in fire gas toxicity can now be more easily studied with another of Dr. Babrauskas' instruments, the phi-meter. In 2008 he was editor for the reference book on toxicity and the hazards of combustion products, **Hazards of Combustion Products**.

Fires from furniture and furnishings were first quantified in the course of Dr. Babrauskas research at NIST. The first predictive methods in this area were also his contribution. He remains very active in this area and has served as consultant to European laboratories investigating furniture flammability. His latest contribution in this area is the textbook **Fire Behavior of Upholstered Furniture and Mattresses**, published in 2001.

In the fire modeling area, Dr. Babrauskas was the first U.S. scientist to develop and make available to the public a computer program for modeling fires—COMPF was released in 1975. Subsequently, he released an enhanced version, COMPF2, in 1979. The enhanced version was the first fire model to include a realistic representation of the burning of liquid pool fires in rooms. He also contributed material to the major NIST fire model HAZARD I.

Dr. Babrauskas' earliest contributions to fire safety were in the fire endurance area. His Ph.D. dissertation was in this area and remains one of the essential references in the scientific study of post-flashover fires and of fire test methods.

Since his founding of FSTI, Dr. Babrauskas specialized in fire safety R&D and in serving as a fire science consultant to fire investigations and fire litigations. In the R&D area, he has been a

technical consultant to three major, multi-national fire safety research projects organized by the European Commission: CBUF, TOXFIRE, and FIPEC. CBUF (Combustion Behaviour of Upholstered Furniture) focused on characterizing furniture fire performance and developing fire models and fire test methods for this category of product. TOXFIRE focused on developing firefighting guidance for fires in chemical and pesticide warehouses, with an emphasis on toxic products of combustion and pollution of air and water. FIPEC (Fire Performance of Electric Cables) was organized to develop fire testing and fire modeling techniques for proper assessment of electric cable flammability. In addition, under the auspices of his own firm, Dr. Babrauskas organized numerous full-scale and bench-scale fire tests on diverse construction products, where the focus has been in assessing strategies for describing the fire toxicity aspects of products.

In 2003, Dr. Babrauskas published a massive **Ignition Handbook**. This 1116-page handbook is the first ever to be published on this topic and was developed as a resource intended to serve fire safety engineers, fire investigators, forensic scientists, insurance company personnel, chemical engineers, and other professionals concerned with fire and explosion safety.

In 2005, the became the first-ever consultant that ASTM formally retained to assist in the process of development of their fire test standards and was tasked with distilling recommendations for ASTM standards from the research findings on the fire and collapse of the World Trade Center.

Dr. Babrauskas has served as editor to two editions (2003 and 2007) of **Fire Science Applications to Fire Investigations**. This is the only extensive, up-to-date collection of research papers on the topics of fire investigation and forensic applications of fire science.

Society memberships

American Society for Testing and Materials (since 1973)
The Combustion Institute (since 1975)
International Association of Fire Safety Science (since 1989)
International Association of Arson Investigators (since 1996)
International Code Council; formerly ICBO (since 1993)
National Fire Protection Association (since 1975)
Society of Fire Protection Engineers (since 1991; grade of Fellow)

Technical committee participation

ANSI US National Committee Technical Advisory Group for IEC/TC 108 Safety of Electronic Equipment, Member (2012-).
ASTM Committee D-9 on Electrical and Electronic Insulating Materials, Member (1991-).
ASTM Committee D-20 on Plastics, Member (1996-).
ASTM Committee E-5 on Fire Standards (1973 -); served as Chairman of Subcommittee E-5.21 on Smoke and Combustion Products (1998 – 2003).
ASTM Committee E-27 on Hazard Potential of Chemicals, Member (1999-).
ASTM Committee E-30 on Forensic Sciences, Member (2004-).
International Association of Fire Safety Science – management Committee (2005-)
ISO Technical Commission of Fire Safety, TC 92/SC 1/WG 2 Working Group on Ignitability, Assigned U.S. expert.

NFPA Technical Committee on Fire Investigations, NFPA 921, Member (2006-).
NFPA Safety to Life/Technical Committee on Furnishings and Contents, Member (1994-).
SFPE Standards Making Committee on Calculating Fire Exposures to Structures Calculating Fire Exposures to Structures, Member (2004-).
SFPE Task Group on Fire Exposures, Member (2002-2004).
UL Standards Technical Panel STP 723 Surface Burning Testing of Building Materials, Member (2003-).
UL Standards Technical Panel STP 1040 Fire Tests of Insulated Wall Constructions, Member (2004-).
UL Standards Technical Panel STP 1820 Fire Tests of Pneumatic Tubing and Plastic Sprinkler Pipe for Flame and Smoke Characteristics (2005-).
US National Committee of IEC, TC108 Technical Advisory Group (2012-).

Editorial positions

FIRE SAFETY JOURNAL, Regional Editor for North America (1989-2009)
FIRE AND MATERIALS, Member of Editorial Board (1990-)
FIRE SCIENCE REVIEWS, Member of Editorial Board (2012-)
JOURNAL OF FIRE SCIENCES, Member of Editorial Board (2005-2012); Associate Editor (2012-)
JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT, Member of Editorial Board (2006-).

Professional awards

Howard W. Emmons Lectureship, IAFSS, 2008 (the Society's highest award)
Arthur B. Guise Medal, Society of Fire Protection Engineers, 2004 (the Society's highest award)
Vilhelm Sjölin Award, Forum for International Cooperation on Fire Research, 2002
Jack Bono Engineering Communications Award, SFPE, 1997
Research Award for Foreign Specialists, Building Research Institute, Japan, 1997
The S. H. Ingberg Award, ASTM, 1995
The Edward Bennett Rosa Award, NIST, 1992
ASTM Award of Recognition, 1991
Interflam Trophy Award, Interflam Conferences, 1990
Building and Fire Research Laboratory Communicator Award, NIST, 1990
ASTM Award of Appreciation, 1989
R&D 100 Award, for developing the Cone Calorimeter, 1988
Research Award for Foreign Specialists, Building Research Institute, Japan, 1988
U.S. Department of Commerce Bronze Medal, 1986

Inventions

The Cone Calorimeter. An instrument for measuring fire properties of materials and products in bench scale. It is currently in the main technique for making this measurement that is in use by laboratories worldwide.

The furniture calorimeter (open-burning products calorimeter). This instrument measures the fire property of furniture items, stored goods, appliances, and other less-than-room sized commodities. It is currently in use in several dozen laboratories worldwide.

The radiant furnace fire toxicity test. This apparatus was jointly developed at several institutions. Dr. Babrauskas headed the NIST development team. It is a bench-scale test used to determine the fire toxicity properties of materials and products.

The phimeter. This instrument determines the real-time combustion equivalence ratio of fires. It is used in studies of fire toxicity.

Engineering standards

The following standards in the fire safety area were primarily developed by Dr. Babrauskas or were based on his inventions:

- ASTM E 1354 (Cone Calorimeter)
- ISO 5660 (Cone Calorimeter)
- NFPA 271 (Cone Calorimeter)
- NFPA 269 (fire toxicity)
- ASTM E 1474 (furniture test, bench-scale)
- NFPA 272 (furniture test, bench-scale)
- UL 1056 (furniture test, large-scale)
- NFPA 267 (mattress test)
- ASTM E 1590 (mattress test)
- ASTM E 1357 (furniture test, large-scale)
- NFPA 266 (furniture test, large-scale)
- NORDTEST NT FIRE 032 (furniture test, large-scale)
- CAN/ULC-S135 (combustibility of materials and products)
- MIL-STD-2031 SH (naval composites)
- NASA NHB 8060.1C (elevated oxygen material test)
- ASTM F 1550M (bench-scale test for prison mattresses and furniture)

Science and engineering expertise and work areas

- instrument design
- physics
- heat transfer
- civil/structural engineering
- electrical engineering
- combustion science
- analytical chemistry: methods for gas analysis
- infrared spectroscopy
- full-scale engineering performance testing

Within fire safety science and fire protection engineering:

- major fire or explosion incidents
- fire resistance
- fire toxicity
- fire testing
- marine and ship fires/explosions

- electrical fires; metallurgy of electrical artifacts
- electrical explosions
- electrical arcs
- furniture flammability
- fire corrosivity
- ignitability
- self-heating and spontaneous combustion
- failure analysis
- ignition of fires from electric faults and failures
- flame spread
- explosions
- heat release rate
- computer fire modeling
- pool fires
- smoke production
- computer methods for handling of fire test data
- design and development of fire test apparatuses and instrumentation

Fire modeling

Dr. Babrauskas was the first U.S. scientist to publish a computer fire model (COMPF, issued in 1975). He contributed material to the major NIST fire model HAZARD I. His model for liquid pool fires is the most commonly used one. During 1993-1994, as technical consultant for the major European research program on upholstered furniture flammability CBUF, he played a pivotal role in developing the three different furniture fire models which were produced. He has developed numerous methods for fire hazard analysis which have been published in various technical journals.

Teaching

Dr. Babrauskas has given hundreds of lectures and presentations. He has taught graduate-level engineering courses at the University of British Columbia and at Worcester Polytechnic Institute. In recent years, he has been regularly teaching classes to fire investigators on fire science principles, as applied to origin-and-cause investigation of fires. He developed the unique **Principles of Electrical Fires** course, which is the only advanced course on investigation of electrical fires focusing on the fundamental underlying principles.

Publications

Dr. Babrauskas has published nearly 300 papers and reports in the field of fire safety science and engineering. His textbook **Heat Release in Fires** is the first and only book on this important subject. His **Ignition Handbook** is the only handbook on the topic of ignition and is one of the largest handbooks published on any safety topic. He authored the first monograph devoted to the topic of upholstered furniture flammability while at NIST; a second edition of this work was published commercially in 2000. He also authored the first comprehensive state-of-the-art review of flammability test methods for wires and cables. His Ph.D. dissertation on **Fire Endurance in**

Buildings is still considered as one of the pivotal references in its field. Dr. Babrauskas has contributed chapters to both the NFPA and the SFPE Handbooks.

A selected list of publications is as follows. The complete listing is available on request.

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Babrauskas, V., Lucas, D., Eisenberg, D., Singla, V., Dedeo, M., and Blum, A., Flame Retardants in Building Insulation: A Case for Re-Evaluating Building Codes, *Building Research & Information* **40**, 738-755 (2012).

Babrauskas, V., Rich, D., Singla, V., and Blum A., Toxic Chemicals and Toxic Money: The Science and Politics of Flammability Standards, *Fire Safety Science News* No. 33, 21-23 (2012).

Babrauskas, V., Blum, A., Daley, R., and Birnbaum, L., Flame Retardants in Furniture Foam: Benefits and Risks, pp. 265-278 in *Fire Safety Science—Proc. 10th Intl. Symp.*, Intl. Assn. for Fire Safety Science, London (2011).

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Babrauskas, V., Electric Arc Explosions, pp. 1283-1296 in *Interflam 2010—Proc. 12th Intl. Conf.*, Interscience Communications Ltd, London (2010).

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Babrauskas, V., and Janssens, M., Quantitative Variables to Replace the Concept of 'Noncombustibility,' pp. 77-90 in *Proc. Fire & Materials 2009*, Interscience Communications Ltd, London (2009).

Babrauskas V., Research on Electrical Fires: The State of the Art (The Emmons Plenary Lecture), pp. 3-18 in *Fire Safety Science—Proc. 9th Intl. Symp.*, Intl. Assn. for Fire Safety Science, London (2009).

Babrauskas, V., Electrical Fires, pp. 3-479 to 3-498 in **The SFPE Handbook of Fire Protection Engineering**, 4th ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., The Cone Calorimeter, pp. 3-90 to 3-108 in **The SFPE Handbook of Fire Protection Engineering**, 4th ed., National Fire Protection Assn., Quincy MA (2008).

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Babrauskas, V., Smoke Detectors: Technologies Are NOT of Equal Value or Interchangeable, *Fire Safety & Technology Bull.* **3**:12, 2-4 (Dec. 2008).

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Introduction

We are fortunate this month that our guest editorial, by Vyto Babrauskas, addresses a key issue in fire protection: advances in smoke alarm technology.

This should also serve as a reminder to all of our readers that the editorial page always remains open for volunteers who would like to contribute ideas intended to help develop fire technology or improve fire safety.

This issue marks the end of the third year of the Fire Safety & Technology Bulletin. I do not want to miss this opportunity to wish all of our readers a Great and Happy New Year and a Wonderful 2009.

Marcelo M. Hirschler

Editorial

Smoke Detectors: Technologies Are NOT of Equal Value nor Interchangeable

By Vyto Babrauskas, Ph.D.

"Smoke alarms of either the ionization or the photoelectric type consistently provide time for occupants to escape from most residential fires." (NIST report Tech. Note 1455-1, February 2008). This message has been delivered to the American public by many institutions over the years, especially NIST. Unfortunately, the message is incorrect, misleading, and has been an active obstacle towards providing better life safety in American residences.

In slightly more detail, the traditional message has been saying that ionization detectors respond more quickly to flaming fires, photoelectric detectors respond more quickly to smoldering, but you don't know which type of fire you will have, so your odds are just as good with either technology. This statement is incorrect for two reasons:

(1) people do not have an equal need for being warned of smoldering, versus flaming fires; and

(2) there are huge differences between the warning time advantages in the two cases. So we need to consider these issues in more detail.

Smoke detectors (smoke alarms) by themselves do not put out fires, their only function is to sound an alarm. A person will most notably need warning if he is asleep. If the person is awake, he is both more likely to observe the fire without the benefit of a smoke detector, and he will also be in a much better position to safely make his exit.

Surprisingly, the US fire statistics reporting system (NFIRS) does not ask the question if the fire originated in a flaming or in a smoldering mode. But the experience of fire officials and fire researchers is that if a fire occurs when the occupants are asleep, it is much more likely to start out as smoldering rather than flaming.

Smoldering fires originate from cigarette ignitions, many electric wiring problems, and numerous types of furnace, fireplace, fluepipe, and chimney malfunctions. Conversely, flaming fires are most typically associated with activities of an awake, alert individual. These include cooking (by far the most common cause of all house fires, although a very high percentage of these fires are never reported), improperly fueling a fireplace, and actively using open flames in the household.

It is not uncommon for fire investigators doing a reconstruction test of a smoldering fire to find that an ionization detector will never sound, although the smoke has gotten so bad that a person cannot see their hand in front of their face. But when ionization detectors actually do work in a smoldering fire, the response is generally extremely slow. In the NIST study mentioned above, photoelectric detectors used with smoldering fires gave 31 minutes more warning, on the average, than did ionization detectors. By contrast,

in the same study, for flaming fires, ionization detectors gave only 48 seconds more warning.

This is a huge disparity, and it does not justify the claim that neither type has an overall advantage. It is also not a new finding. In 1978, researchers at the Fire Research Station in England (Kennedy et al.) ran smoldering-fire tests and found that photoelectric detectors gave warning on the average 113 minutes before ionization detectors did. Another study (Schuchard, 1979) found that for smoldering mattress fires, photoelectric detectors sounded an alarm on the average 59 minutes quicker than did ionization detectors. A study organized by NFPA (Drouin and Cote, 1984) found a 68 minute faster photoelectric detector response in the case of a smoldering fire, but only a 12 second faster ionization detector response for flaming.

The latest results are from experiments by the National Research Council Canada (Su et al., 2008) involving 11 flaming house fires. These showed an average 16 s alarm time advantage for ionization detectors, compared to photoelectric. Thus, it is clear that photoelectric detectors will provide a huge advantage in smolder fires (30 minutes to 1 hour, or more), while ionization detectors provide a trivial advantage (a few seconds) in flaming fires.

By the way, proponents of ionization detectors sometimes argue that, even though the time advantage of ionization detectors for flaming fires may be very small, it is still an important advantage since flaming fires reach untenable conditions much more quickly. This is a specious argument, since it fails to take into account human behavior. In a real fire emergency, individuals do not behave in a robotic fashion, moving quickly and directly to the correct exit. Instead, they are most likely to engage in numerous activities before proceeding to the exit and may, even then, choose a poor exit. Minutes, not seconds, are generally likely to be needed before all the occupants of a house have successfully exited. In the context of that reality, a time difference of 12-48 seconds is very unlikely to make the difference between life and death.

The NIST policy of claiming that detector technologies are interchangeable, as far as occupant protection goes, is actually very old. Their original "Indiana Dunes" studies of 1975-77 contained the same conclusions. At the time, this was a reasonable conclusion, since (a) most houses did not have any detection and it was considered that any type of detector has to be better than nothing; and (b) during that era, battery-powered photoelectric detectors were not yet available, while battery-powered ionization detectors were. Since the initial push had to focus on retrofits, rather than new housing, it was essential to not discourage householders from installing ionization detectors. But battery-powered photoelectric detectors have now been available for more than two decades; consequently these original reasons have lost all of their validity.

An additional reason why photoelectric detectors should be preferred has to do with false alarms. A large fraction of fires that become serious involve homes where a smoke detector once existed, but was then disabled. This is most commonly due to excessive false alarms. A study in Alaska (Fazzini et al., 2000) found that false alarms are 9 times more likely to be experienced for houses with ionization detectors, as compared to photoelectric ones.

For a number of years now, consumers had the ability to buy a combination sensor detector, where both ionization and photoelectric detector elements are incorporated into one device. Theoretically, such a detector would be the ideal detection device. In actuality, this turns out not to be the case. Evidently most of the manufacturers made the unfortunate decision in designing these units to focus on false alarms rather than on detection time. The consequence is that these dual-mode detectors do not offer the early-warning advantage that they would be capable of, if appropriately designed.

It is sometimes argued that photoelectric detectors should not be promoted because their retail price is roughly double of the ionization detectors. This is not a reasonable claim, since even with the price premium, a photoelectric detector can easily be purchased for $20.

But the price difference is solely a chicken-and-egg question. Photoelectric technology does not require costlier parts to make the unit, nor is it more complex. But single-station ionization detectors currently outsell photoelectric detectors by around 20:1. Consequently, manufacturers charge more for photoelectric units, simply because the market is much smaller. Interestingly, in commercial occupancies, central-panel type smoke detectors are predominantly photoelectric, rather than ionization. But this does not have a large effect on fire fatalities, since, if an individual dies in a fire, this is overwhelming likely to be at home and not in an office, workplace, school, or other non-residential occupancy.

Very recently the situation is beginning to improve, due especially to the efforts of Jay Fleming, Deputy Chief at the Boston Fire Department. Chief Fleming found that there were recurring fire fatalities in Boston which could have been prevented had the occupants used photoelectric, instead of ionization detectors. Thus, for a number of years he campaigned to introduce requirements mandating photoelectric detectors.

Fleming's efforts are now starting to bear fruit, primarily in the Northeast. A number of jurisdictions have recently issued regulations which will require photoelectric technology. Details of these, along with an engineering analysis of problem will be given in a paper (Babrauskas, Fleming, and Russell) at the Fire and Materials 2009 conference in January (*see Calendar*).

RSET/ASET, a Flawed Concept for Fire Safety Assessment

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Abstract

For the evaluation of occupant safety in the case of building fires, the Required Safe Egress Time/Available Safe Egress Time (RSET/ASET) concept has become widespread and is now commonly used in the fire safety engineering profession. It has also become commonly used by smoke detector (smoke alarm) manufacturers in assessing whether a particular detector technology is adequate. It is shown in this paper that the concept is intrinsically flawed and its use promotes the diminishment of fire safety available to building occupants. The concept innately ignores the wide variations in capabilities and physical condition of persons involved in fire. It is based on implicitly assuming that, after a brief period where they assess the situation and mobilize themselves, occupants will proceed to the best exit in a robotic manner. This assumption completely fails to recognize that there are very few fires, especially in residential occupancies, where occupants perished or were seriously injured who had endeavored to exit in this robotic manner. Instead, in the vast majority of fire death and serious injury cases, the occupants did not move in such a manner and their evacuation took longer than anticipated on the basis of robotic movement. There is a wide variety of reasons for this, and these are well known in the profession. The concept also ignores that there can be a wide variation in fire scenarios. The same building and the same fire protection features can be evaluated, but both RSET and ASET can change drastically, depending on the scenario used. The consequence of using the RSET/ASET concept for fire safety engineering or product design purposes is that fire deaths and injuries are permitted to occur which are preventable.

Keywords: available safe egress time; escape behavior; fire escape models; human behavior; required safe egress time; smoke alarms; smoke detectors; tenability in fire.

Introduction

Most fires will become lethal to a building occupant, if the occupant remains exposed to the products of combustion for a long enough time period. Since early and successful extinguishment cannot be ensured for all cases, fire safety strategies for buildings are generally based on timely evacuation of occupants[1]. Since a fire may not be obvious to the occupant, especially when sleeping, warning of the occupants by a smoke detector[2] is a necessary feature of fire safety.

The mother was woken by a smoke detector, which sounded, but sounded late. She found one of her children and brought the child out of the burning building. She then went back in to get her other child.

[1] This concept applies only to normal buildings. In some situations, evacuation is impossible and different fire protection strategies are needed. Such exceptions includes submarines, aircraft in flight, and other specialized situations.

[2] We shall use the term smoke detector for all types of devices which are designed to cause an audible alarm to be sounded upon the detection of smoke. Some authors distinguish between central-panel-connected 'smoke detectors' and single-station 'smoke alarms.' For the purposes of this paper, we do not distinguish between these types of devices and will apply the term 'smoke detector' to either type of device.

But she was overcome by smoke while inside and perished. The second child, meanwhile, had exited by himself through another exit and was no longer in the house. In another family, children were being taken care by a babysitter. A fire started on the first floor of a house. There was a smoke detector response, but it was late. The babysitter brought one child out successfully. Then she went to look for the second child. The other child meanwhile had attempted to escape herself, but made the wrong choice of going upstairs, instead of heading for the front door. By the time the babysitter reentered, the stairs were impassable and the child died.

In another fire, the family was in one part of the house, while electrical wiring started a smoldering fire in the living room. Eventually, the fire ignited the Christmas tree, which started burning rapidly. The smoke detector sounded, but too late. The father thought that he could take the tree outside, but enough of it had come alight that he got badly burned in the process. A smoldering fire started in the sofa. After a very long time, the smoke detector sounded and the mother was woken. She rounded up her two children and attempted to escape through the back door. Unfortunately, the back door had an inside-key deadbolt and she could not get the key to work, despite fiddling with it. Eventually, she decided to exit through a window and get a neighbor's help to break the door down and rescue the children, who had meanwhile run away from her. But when the neighbor arrived, he had to restrain her from reentering, since the fire would have been lethal to anybody reentering. The two children perished. Fire histories of this type are exceedingly common and are known to most fire safety practitioners. The common thread in all of them is that the occupants were notified of the fire when the fire was at a late enough stage so that there would probably have been enough time to move robotically to an exit, but not enough time to have an intervening activity take place.

Another category of slow occupant responses is those where the occupants are moderately slowed down due to their physical condition. Obviously, if occupants are bed-ridden and immobile, or so intoxicated that waking is precluded, it is not expected that a smoke detector's warning will benefit them, even if a very early alarm were sounded. But when occupants are only modestly infirm, the fire safety profession should not dismiss the potential for them to be saved. Examples here would be a person with a leg cast, or one who has taken a tranquilizer, but is still able to wake to an alarm sound, albeit not to move rapidly thereafter.

A number of specific cases have also been documented in the files of the Consumer Product Safety Commission (CPSC). During the night, a student at the University of Miami of Ohio [1] was awoken by the sound of a smoke detector. According to fire reports, the fire was started by smoking materials igniting furniture. When he opened the door of his bedroom, the smoke was so thick that he had to jump out the window to escape. He was joined by the two students in the adjacent bedroom, as well as several students on the second floor, all of whom also jumped out windows. Three students died who did not jump out of windows. Newspaper stories blamed the students for possibly being impaired, suggesting that they took an especially long time to respond to the alarm and then commenced inefficient. But according to official reports, the student who first awoke to the smoke detector was not impaired, yet at the time that he awoke the egress paths were already blocked. The tragedy could have been avoided had the smoke detector sounded earlier.

In a fire in Georgia [2], a 57 year old woman and her 96 year old mother died in a fire, thought to be electrical in nature, that smoldered for a period of time. Initial reports from fire investigators stated that "smoke detectors were operational but were not in the area where the fire started," implying a delayed detection time. Investigators also noted that "the 57 year old did not know the layout of the home and wasn't able to break a window," implying a slow egress time. Both assumptions were attempts by the investigators to explain why two people died despite working smoke alarms. However, after further analysis, investigators came to the conclusion that the smoke had plenty of time to reach the detector and that the most likely reason for the occupants being trapped was the delayed response of the smoke alarm.

Around 6:00 a.m., two adults awoke to the sound of a smoke alarm and realized that it was coming from the apartment next door [3]. Despite heroic attempts, thick smoke prevented them from rescuing the 23 year old mother and her small child. According to investigators this was an electrical fire that started adjacent to the mother's bed. The child was trapped because she was incapable of self-rescue; yet she could have been evacuated had her mother been able to act. But the mother was likely incapacitated by high levels of CO, yet high levels of concomitant smoke did not activate the smoke alarm.

Development of the RSET/ASET concept

In the evaluation of fire safety for buildings or other places of human occupancy, the modern trend has been to seek to establish quantitative performance metrics. Quantification is always desirable, but especially so when a comparison of two or more alternative strategies is to be made. The most important area where this has been of issue is the provision for adequate escape potential for the occupants of a place where a fire has started. Over the last few decades, a metric has arisen where adequate consideration has not been given to its correctness, since superficially it seems to be a sensible concept. The concept is that occupants of a place undergoing a fire will require a fixed, calculable (or prescribable by *fiat*) time to make their escape. This time is called RSET, the **R**equired **S**afe **E**gress **T**ime. A parallel calculation is then made of ASET, the **A**vailable **S**afe **E**gress **T**ime. If the simple relation ASET > RSET is fulfilled, then it is deemed that the building's fire safety is fully adequate, at least in regards to the safety of escaping occupants. The calculations involved are usually simple to make and the arithmetic relationship is trivially easy to evaluate.

The first significant example of use of the RSET/ASET was the 1975 "Indiana Dunes I" smoke detector study sponsored by NIST [4]. At that time, the terms RSET and ASET were not yet developed, but the evaluation of occupant fire safety in this research study was done using the concept, albeit without the explicit nomenclature.

In the first phase of the Indiana Dunes I study, there was surprisingly no account taken of the time the occupants will consume to make their ultimate escape. The authors simply assumed that, if there was any time, regardless how slight, after the alarm was sounded and before untenable conditions were reached on the escape route, "success" was achieved. In other words, the assumption was made that the occupant will need zero time to make the escape. In 1976, Phase 2 of Indiana Dunes I testing was reported [5], and the analysis was also identical. In 1983, Waterman, one of the authors of the Indiana Dunes I studies, published a follow-on paper [6] which stated that, of course, people will need more than zero time to make their escape, but he did not reanalyze the data with that in mind. Instead, he referred to an unpublished study by Rexford Wilson, who had reanalyzed the data on the basis that it would take the occupants 1, 2, 3, 4, or 5 minutes to effectuate their escape. Wilson then recommended that, of these choices, 3 minutes should be selected. This was taken to be conservative, since tests conducted by the City of Los Angeles Fire Department showed that, in a staged exercise, all occupants would escape in less than 1 minute. The staged exercise involved persons who were woken from sleep by a simulated fire alarm and were to make their exit upon being woken.

In fairness, it must be pointed out that, while it is obvious today that, in many cases, people perish in fires since they do not move robotically toward a viable exit, this was not necessarily widely known in the mid-1970s. In 1977, Stahl and Archea [7] published a state-of-the-art review of the literature on the emergency evacuation of buildings. The paper discusses the fact that occupants may not proceed to an exit upon being notified by an alarm signal, if they perceive that this is unlikely to be a real fire. It also establishes that it was already known in the mid-70s that an occupant is likely to "investigate" the status of the fire before commencing the escape. But the authors only make reference to only a single, unpublished paper which discusses the possibility that an occupant may reenter a burning building, and no references to any other behaviors which would cause a significant delay in the person's exiting the

building. No instances of attempts to fight a fire that have gone badly wrong are cited. Furthermore, the majority of studies to that date focused on commercial or institutional occupancies and on high-rise buildings, rather than single-family homes, even though the latter are where the overwhelming majority of fire deaths occur. It is the view of the present authors that evacuation studies of institutional buildings should not be used as the basis for assessing fire safety in residences. Apart from the basic fact that fire deaths in commercial/institutional occupancies are comparatively rare, human behavior in private homes tends to be different than in public occupancies. It is extremely unlikely, for example, that a person would delay the escape from an office building due to searching for their pet dog. More important, people are rarely asleep in a commercial building when a fire occurs. Even studies on high-rise housing tend not be helpful towards understanding fires in single-family homes. In 1981, a more comprehensive review paper [8] was able to identify three studies where reentry of buildings was mentioned. But it again demonstrated that the published studies on human behavior in fires remained highly focused on commercial, institutional, and high-rise buildings, devoting but little effort to examine common behavioral aspects associated with fire deaths in single-family houses.

The first important study to focus on non-robotic behavior of people was not available until 1987. In that year, Levin [9] described his EXITT evacuation model, which was the first computer model to consider that human movements in fire are different from water flowing through a channel or marbles sliding downhill[3]. It explicitly described that the first action of a person becoming aware of a fire is to "investigate" the fire, which will usually involve moving towards the fire, and not away from it. It also considered that in residences (unlike in public occupancies), upon learning of a fire, a person is likely to first look for, and attempt to rescue family members. Once these preliminaries are completed, however, the occupant was not allowed further counterproductive actions in Levin's model.

The actual RSET/ASET terminology itself and the mathematic relationship "ASET > RSET" were first explicitly set forth by NIST's Cooper in 1983 [10]. Interestingly, Cooper was a fluid mechanics specialist and did no work on the RSET part of the equation. For ASET, he proposed a fluid-mechanical program that calculates when the upper gas layer descends down to a person's head, at which point the ASET time period is terminated. The calculation of RSET he left to others.

Adoption of the RSET/ASET concept

The early history of the RSET/ASET concept was a NIST development. In more recent times, the concept has become widespread, not only throughout the US design community, but also internationally. Barely two years after NIST proposed the concept, the late Jonathan Sime, who was a specialist on human behavior in fires, proposed a revised RSET scheme [11]. Instead of assuming that the only time the individual will need is to react to the alarm signal and march robotically to the optimal exit, he set forth that RSET must consist of three components: $RSET = T_r + T_c + T_e$, where T_r = recognition phase, which includes acts such as investigating; T_c = coping phase, which includes acts such as firefighting; and T_e, = escape phase, which involves all activities that transpire thereafter, until the occupant actually exits the building. Conceptually, Sime's scheme would be perfectly satisfactory, since the defined periods are elastic enough to accommodate the activities that realistically may transpire. Practically, however, the scheme is unsound, since it implies that a fixed, specified amount of available time is "good enough." By contrast, a safety-oriented methodology should deliver the maximum escape time that can be physically and economically provided.

It is also common to find the RSET/ASET concept used as an integral part of the performance-based option in the NFPA 101 Life Safety Code [12], although the latter is not widely used in connection with single-family housing. NFPA's Fire Alarm Code, NFPA 72 [13], also contains a performance-based

[3] Even today, it is rare to find any evacuation model which considers the actual behavior of the occupants and is not simply a mechanistic exercise in mathematics.

option but, again, this option is generally used for occupancies other than single-family housing. The Society of Fire Protection Engineers has issued a Guide [14] on human behavior in fire, where they recommend the use of the RSET/ASET concept. The Guide briefly refers to some studies documenting counterproductive activities, but then SFPE makes no recommendation that time be allowed for such activities in doing calculations.

Interestingly, not long ago NFPA's John Hall published a paper entitled "How many people can be saved from home fires if given more time to escape?" [15]. Hall endeavors to use existing statistics to answer this question, even though he recognizes that these are problematic. In the course of analyzing the statistics, Hall makes some decisions which are inexplicable. He considers that some victims are described as "acting irrationally" and these are unlikely to benefit from having additional escape time. He cites as an example of irrational activity the common situation where a victim ends up in a closet and perishes there. These are invariably either small children, or else adults who got lost due to thick smoke. Thus, in fact, the opposite is true: these victims would almost assuredly have been saved had there been enough warning. With enough warning, escaping occupants will not encounter smoke which is extremely thick and will see the correct egress path. Small children will need adults' help in any case to exit. But if time is sufficient, there will be time for adults to round up and escort the children and there will be no reason for them to meander off by themselves into a closet. It is also generally considered an irrational activity to go back into a burning house to remove possessions or search for pets. But, again, if there is sufficient time provided between when an individual is first warned of a fire and when conditions get terminally bad, the likelihood is increased that individuals performing such counterproductive acts will still be saved. Hall also does not adequately address the reality that some 'irrational' behavior is caused by loss of mental and decision-making capacities due to CO and toxic gas exposure.

Hall also considers that individuals who are "unable to act," since they are too young or are physically impaired, are unlikely to benefit from having additional escape time. This is an overgeneralization. If such individuals are alone in the house, then this is likely to be true. But in many cases there are competent adults in the same household. It will take much more time to assist an impaired individual, but if a competent adult is available, there is no reason to believe "unable to act" individuals will not benefit from having increased escape time. It is important to note that, despite these problems with the approach, Hall concluded that, for individuals capable of reacting to an alarm sound, roughly half of the deaths and 2/3 of the injuries could be prevented if more time was available between alarm and the point when conditions become untenable. This ultimate conclusion, of course, precisely supports our thesis. Curiously, despite emphasizing agreement [16] with Hall's conclusion, NIST remains [17] an advocate of the kind of RSET/ASET methodology which is detrimental towards saving lives.

The National Research Council Canada (NRCC), where much valuable research on human behavior in fires has been done, recently published a study [18] where the authors accede to the RSET/ASET concept. Yet, at the same time, they point out[4] that, for normal, healthy individuals in a Canadian single-family house at night, as much as 11 min can be required after sounding of the alarm before the occupant has finally exited the premises. This is a helpful antidote to Wilson's notion that 3 min should be perfectly adequate.

In recent years, the International Organization for Standardization (ISO) has taken the lead in promoting the RSET/ASET concept. The first-generation ISO document on this topic was ISO 13387-8 [19]. It instructs the reader to use the RSET/ASET concept, but without giving any details how to do it. Functionally, the document espouses Sime's rewrite of the RSET concept, except that 'recognition phase' and 'coping phase' are lumped into a single 'pre-movement time.' This term is unfortunately misleading,

[4] The NRCC report states that an RSET up to 16 min can be needed, of which 5 min is the time between the ignition and the sounding of the alarm, while 11 min is the post-alarm time.

however, since 'pre-movement time' actually includes the time when the occupant is in motion, but not yet on the ultimate path towards the exit. Even more confusingly, Cooper, Sime and the earlier researchers assumed that, for RSET and ASET, t = 0 corresponds to the time of the sounding of the alarm. ISO redefined these times to begin at ignition, and not at the time of the alarm. Thus, at the present time, if RSET and ASET terms are used, the start time is ambiguous, unless the author makes this explicitly clear. ISO 13571 [20] explicitly instructs the reader to make use of the RSET/ASET concept, although it fails to give any useful guidance for actually doing it. ISO 19706 [21] mandates the use of the RSET/ASET concept, but refers to other ISO standards for the actual details. Finally, ISO is in the process of developing ISO 16738 [22], which is devoted solely to giving guidance on doing RSET/ASET calculations. The current draft discusses at length various human factors, but in the final analysis, ends up wholeheartedly recommending RSET/ASET calculations as a mathematical exercise in physics. The concept that as much escape time as physically and economically viable should be provided does not enter into it, and it continues the RSET/ASET orthodoxy that the minimum calculated RSET is sufficient, and the benefits of providing more are not considered. Disappointingly, the document explicitly points out that counterproductive, time-consuming behavior may be encountered in a fire, but then illogically assumes that the analyst can successfully do some mathematical calculation to account for all that. This document keeps the ISO 13387-8 notion that there will be some time elapsed prior to movement, but the 'pre-movement time' is renamed 'pre-travel activity.' Following ISO's lead, various countries have subsequently taken on the RSET/ASET concept. For instance, a recent paper from the Peoples' Republic of China [23] explains that Chinese fire evacuation provisions for subway trains are based on RSET/ASET.

Using RSET/ASET

Despite the use of quantitative variables, the evaluation of both RSET and ASET is highly subjective. To calculate ASET, one must quantify the conditions (and therefore, the time) when occupants will no longer be able to move safely through the exit path and into the outdoors or similar safe area. This is a two-part problem: setting 'tenability' or 'incapacitation' criteria, and then assessing the results of experimental fires or computer calculations against these criteria. With criteria in hand, the assessment is trivial, but the criteria themselves are not amenable to any sort of rigorous study. The basic problem is that there is a complex interaction between physical and psychological variables and these are not suitable for experimental study (one generally cannot perform experiments that would endanger human volunteers, while animals do not constitute a suitable surrogate where human intelligence is involved). Thus, various criteria have been proposed [e.g., 20], but they are highly arbitrary and have little basis in either physics or physiology. There is even no agreement in the profession as to the nature of the population to be protected: should it be the average individual? or should it be a deliberately-selected case of infirmity? or should it be based on a normal population distribution, but taken at some level much below the mean? if so, how much?

Even though ASET has been ill-defined and lacking objectivity, the problems are much worse with RSET. The basic RSET concept is that human beings act like robots and will proceed to march to the correct exit in a linear and straightforward manner. This time to accomplish this has acquired the name 'movement time' and represents simply extrapolations primarily from fire drills. Some actual fire evacuations have been studied, but these invariably have been of successful evacuations, i.e., dead victims were not studied. To this robot-like 'movement time' is added a 'pre-movement time,' with the sum of the two comprising RSET. The pre-movement time attempts to take into account the psychological fact that victims are not athletes waiting for the starter's signal, but rather will require a certain time before they proceed to move anywhere, and an even further time before they decide to go towards the exit. As mentioned above, the latest Canadian study pointed out that up to 11 min might be invested in different actions by the occupants, once the alarm sounds. This finding appears to have been totally ignored, presumably either due to conflict with preconceptions or possibly due to a refusal to recognize the facts of human behavior. We can find no other papers espousing the need for realistic times to be used. Instead, in

the latest NIST study on this topic [24], pre-movement times in the range of 0 to 80 s (this is not a misprint) were used. NIST further elaborated that the maximum 80 s pre-movement time should pertain only to occupants identified as 'elderly,' while the remaining population was expected to not consume more than 50 s. Neither the elderly nor the non-elderly were presumed to be consuming time to search for, or assist others. In actual fact, a mother with four small children would be expected to be able to safely rescue each and every one of them, despite the fact that this is a four-fold burden.

The RSET concept is fundamentally flawed because both the movement and the pre-movement times are viewed as fixed numbers that can be adequately obtained and that will provide adequate safety for the intended occupants. As explained above, reality is very different from this mechanistic view and an individual may require what somebody unacquainted with the circumstances might judge to be an "unreasonable" amount of time. Even individuals who are normal and without the responsibilities of caring for others may take a long time if they had taken some medicine which made them sleepy and slow to react. Thus, RSET is innately a stochastic distribution and it is improper to reduce it to a single number, and flagrantly improper if the chosen number is not at the high-end tail of the distribution.

The solution to this situation does not lie in re-computing movement and pre-movement times on a more realistic basis. This is because the basic RSET/ASET concept converts a quantitative question into a categorical one. The correct question to ask when comparing fire safety strategies is: "What is the available safe egress time with Strategy B, compared to Strategy A?" This is to be answered quantitatively. If Strategy B offers significantly more egress time than Strategy A, then it is the one that should be chosen, assuming that the implementation is affordable. The RSET/ASET scheme, however, converts this pivotal safety problem into a triviality: If RSET = 100 s, ASET for Strategy A = 105 s, while ASET for Strategy B = 1000 s, then both strategies fulfill the requirement that ASET > RSET and, consequently, both are deemed to be equally acceptable. In actual practice, no fire safety strategy can be 100% successful, since for some individuals RSET $\rightarrow \infty$. But the likelihood of saving lives will be increased if the assessment strategy used recognizes that as ASET is progressively increased, more and more lives will be saved.

Smoke detectors as a case example

The RSET/ASET analysis originated with research on smoke detectors. Not surprisingly, this is the one area where use of the concept has led to the greatest problems in its application. Use of the RSET/ASET concept has formed the basis for various published studies giving the conclusion that photoelectric and ionization smoke detectors are 'equally' competent at saving lives. But examination of the actual test data then shows that the conclusions would be very different if the RSET/ASET concept had not been used. Both types of detectors 'save lives,' but a proper analysis of the large body of collected data very clearly indicates that these technologies are not equivalent, and that use of photoelectric smoke detectors in the home would result in a notable increase in 'saving lives.' Extensive performance testing of photoelectric and ionization detectors by Texas A&M University in full-scale house fires, revealed very delayed response of ionization detectors to certain fires even though conditions were rapidly becoming untenable. RSET/ASET analysis of such data for an 'average' detector response gives a false conclusion that photoelectric and ionization detectors are both adequate when, in reality, ionization detectors frequently only sounded so late as to be ineffective [25].

NIST's latest series of tests (sometimes called "Indiana Dunes II" to indicate that it is a modern revisitation of the original 1970s work) [24] can perhaps be best used to illustrate why the RSET/ASET concept is inimical to life safety. The NIST Press Release [26] on the study stated that: "Smoke alarms are of two types—ionization and photoelectric. Some combination models are sold. According to the two-year NIST home smoke alarm performance study, ionization smoke alarms respond faster to flaming fires, while photoelectric smoke alarms respond quicker to smoldering fires. The report concluded that, despite these differences, the placement of either alarm type on every level of the house provided the

necessary escape time for the different types of fires examined. The researchers determined the necessary escape times [i.e., RSET] by considering the time that the alarms sounded in various locations and the development of untenable (unsurvivable) conditions [i.e., ASET]."

The problem with this NIST conclusion is that it is not supported by the data obtained in the study. Table 1 is part of the analysis of the data that NIST published [27] in response to questions [28] regarding the study. But such a simple RSET/ASET analysis using averages fails to bring out several important findings:

(1) In the smoldering scenarios, the ionization detectors often did not provide the necessary escape time.

(2) In the most common flaming scenario (cooking fires), the photoelectric detectors, although a little slower, provided at least 8-9 minutes for most fires.

(3) In the Fast/Ultrafast Flaming scenario, neither type of smoke detector may provide sufficient warning if the occupants are asleep.

(4) These results have to be put in the context that most flaming fires occur while occupants are awake (very small RSETs), while the vast majority of smoldering fires occur while occupants are asleep (potentially long RSETs).

Table 1 Average ASET times, along with their standard deviations, as compiled by NIST [27]

	ASET (s)	
	Photoelectric	Ionization
Smoldering fires	2136 ± 1001	276 ± 331
Flaming fires*	129 ± 74	177 ± 69
Cooking fires**	739 ± 148	796 ± 241

* Fast/Ultra-Fast fires

** Medium/Fast fires

In the Report [24] itself, NIST provides a more accurate statement, "Both common residential smoke alarm technologies (ionization and photoelectric) provided *positive escape times* in *most* fire scenarios." NIST is correct in stating that there were positive escape times in most scenarios (57/64) but they fail to point out that the most common smoke detector in use, i.e., the ionization type, fails to provide a positive escape time in a large fraction of the smoldering fires which could be the most common type of fatal fire that occurs while people are sleeping (Table 2).

Table 2 Tests with positive ASET results

	Number of tests with "positive escape times"	
	Photoelectric	Ionization
Smoldering (12 fires)	12/12	7/12 (est.)
Flaming (16 fires)	15/16	16/16
Cooking (4 fires)	4/4	4/4
Totals	31/32	27/32
	58/64	

Focusing now specifically on smoldering fires, Table 3 gives the ASET results for the smoldering fire tests, as reported by NIST [29]. For the 30 cases (10 tests, 3 variants) considered (tests where data were not successfully collected for both detector types are excluded here), the average ASET = 1794 s for the photoelectric detectors and 160 s for the ionization. It can easily be seen that 1794 >> 160 and that, consequently, the photoelectric technology is the one that is more likely to save lives. This, however, is not how NIST's interpretation was made. Again, it should also be noted that NIST's conclusions were

based on 'average' smoke detector performance, even though in certain test fires, ionization detectors failed to sound at all.

Table 3 Available Safe Egress Time, ASET (s) for smoldering fires in the NIST Indiana Dunes II tests

Test	Type	Photoelectric			Ionization		
		Every Level	Every Level + Bedrooms	Every Room	Every Level	Every Level + Bedrooms	Every Room
SDC01	Smoldering chair in living room	1015	1015	2865	190	190	1085
SDC04	Smoldering mattress in bedroom	2290	2290	2290	95	105	105
SDC06	Smoldering mattress in bedroom	2650	2650	2650	65	70	70
SDC08	Smoldering mattress in bedroom	18	1432	1432	22	74	74
SDC11	Smoldering chair in living room	92	92	3458	100	100	378
SDC23	Smoldering chair in living room	3298	3298	3298	16	16	16
SDC27	Smoldering chair in living room (air conditioning)	2772	2800	2800	-54	-54	-54
SDC31	Smoldering chair in living room	270	270	1076	230	230	416
SDC34	Smoldering chair in living room	26	26	2254	26	26	374
SDC37	Smoldering mattress in bedroom	568	568	568	298	298	298

In 2000, Fleming [30] proposed a way of restructuring the RSET/ASET concept for smoke detectors, so it would no longer be inimical to life safety. It requires defining:

$$\textit{Margin of Safety} = \textit{ASET} - \textit{RSET}$$

The *Margin of Safety* variable, which is a quantitative variable, is to be maximized in order to improve life safety. By comparison, the RSET/ASET scheme is a categorical assignment:

$\textit{Margin of Safety} \geq 0 \quad \rightarrow$ Pass

$\textit{Margin of Safety} < 0 \quad \rightarrow$ Fail

As explained above, one of the major faults of the RSET/ASET scheme is that RSET values, far from being some simple calculation or measurement, are actually a poorly-defined stochastic distribution. But by using Fleming's *Margin of Safety* variable, this would be less of an obstacle. For the purposes of making a comparative design, one could fairly arbitrarily select an RSET value, and it would still be clear which of two alternate designs provides better life safety. It bears emphasizing that only comparative, not absolute, designs can ever be rationally made. Since RSET is a stochastic distribution, it has neither a design value nor a fixed upper limit. Thus, one cannot ever conclude that a design is "good," but only that design A is "safer" than design B. However, it should be clear that such a solution is practical and is not an obstacle to competent design.

Table 4 shows the values for the *Margin of Safety* in the NIST tests considered above. These correspond to RSET = 65 s, which is the value specified in NIST's spreadsheet [29]; the published NIST report considered RSET values ranging from 5 s to 140 s without adopting a unique value. Using the categorical RSET/ASET concept, "success" is found for 27 out of 30 cases for the photoelectric detectors and for 21 out of 30 cases for the ionization detectors. But using *Margin of Safety*, it can be seen that the average

margin of safety is 1606 s for photoelectric detectors, and 95 s for ionization detectors. Again, we emphasize that an unrealistic RSET = 65 s value was specified. If Wilson's 3 min value were used, the margins of safety would become 1491 s for the photoelectric detectors and –19 s (i.e., occupants became incapacitated and failed to exit) for the ionization detectors. It must be emphasized that this stark conclusion of "occupants got incapacitated and failed to exit" applies now to the average result for the ionization detectors, and not just a few unfortunate cases. But, as described above, NRCC's 11 minute value is a much more realistic example to consider, if saving occupants is the objective. In such case, the average margin of safety becomes 1011 s for the photoelectric detectors and –500 s for the ionization. The evidence is clear which is the preferred solution, and which is a failure.

Table 4 Margin of Safety (s) for smoldering fires in the NIST Indiana Dunes II tests

T...	Type	Photoelectric			Ionization		
		Every Level	Every Level + Bedrooms	Every Room	Every Level	Every Level + Bedrooms	Every Room
...01	...dering c... in living ...	950	950	2800	125	125	1020
SDC04	Smoldering ...ress in bedroom	2225	2225	2225	30	40	40
SDC06	Smoldering ma...ss in bedroom	2585	2585	2585	0	5	5
SDC08	Smoldering ...ss in bedroom	-47	1367	1367	-43	9	9
	...dering ... in living	27	27	3393	35	35	313
...23	...ng chair in living ro	3233	3233	3233	-49	-49	-49
SDC27	Smoldering chair in living room (air conditioning)	2707	2735	2735	-119	-119	-119
SDC...	Smoldering chair in living ...m	205	205	1011	165	165	351
SDC34	S...dering chair in living ro...	-39	-39	2189	-39	-39	309
...C37	Smoldering mattress in bedroom	503	503	503	233	233	233

The results of Table 4 can be used to illustrate two main points: (1) in smoldering fires, photoelectric detectors provide vastly more escape time than ionization detectors; and (2) ionization detectors often are not providing even minimally sufficient ASET for the occupants. The NIST data (as opposed to the NIST conclusions) generally agree with previous research [e.g., 31] where long-smoldering synthetic materials were tested. However, some of the results of this study are confusing or misleading and were not resolved despite specific notification [28]:

(1) For various bedroom fires (SDC04, SDC06, SDC23, etc.), the ASET did not change when a detector is located in the room of origin, as opposed to in the hallway. This is probably due to the fact that NIST did not have a smoke detector located in the room itself.

(2) For some fires (e.g., SDC34), the difference between the photoelectric and the ionization detectors in the burn room was only a few seconds, while the difference in the hallway right outside the room was more than 1000 seconds. No other researcher studies [e.g., 32] found this type of variance.

(3) For one living room fire (SDC23) the detectors on the 2nd floor landing responded several thousand seconds before the detectors in the foyer on the 1st floor, directly outside the living room.

It is disturbing that the NFPA 72 Technical Committee [33] had a task group consider the RSET/ASET concept in great detail, as propounded in the latest NIST study, and ended up wholeheartedly endorsing both the RSET/ASET concept and the fallacious notion that photoelectric and ionization detectors are equally suited for residential fire detection purposes. The Committee explicitly considered the various factors involved in defining the ASET, but peremptorily accepted NIST's unrealistic RSET values and did not in any way consider the life safety of individuals who behave in a non-robotic fashion. It may be noted that the only two fire service personnel assigned to the task group—individuals who would most likely be most familiar with occupant behavior in residential fires—recorded their dissent from the endorsement.

Summary and conclusions

Human behavior in fires is not mechanistic or robotic. It is common to find that individuals engage in actions which are counterproductive, unsafe, or seemingly unreasonable. A robot could evacuate a house in a very short time. Yet people encountering fires in their homes often behave much less efficiently and become trapped in a fire. Consequently, engineering strategies which ignore these realities are flawed and will necessarily give misleading conclusions.

The RSET/ASET concept was originally developed in 1975/76, even though it did not acquire the terminology until somewhat later. Most of the early literature on evacuation was focused solely on fire drills, and none of it involved single-family houses. During the 1970s, a few research studies began to be done where single-family house occupants were interviewed. But these few studies focused on examining the evacuation of occupants who had successfully evacuated, and not on determining the activities of individuals who perished.

Since the majority of studies on human factors in fire historically focused on occupants who were successful in escaping from fires, not ones who were unsuccessful and perished, this created the misleading impression that designers can solely consider behaviors which are goal-oriented and ignore behaviors which are counterproductive or otherwise detract from expeditious exiting. These priorities should be reversed—to improve fire safety, it is much more important to study the failures than the successes. This, of course, is more difficult since decedents cannot be interviewed nor can they fill out questionnaires. But, in most cases, facts can be gleaned by interviewing firefighters, neighbors, and family members.

The RSET/ASET concept is highly simplistic and offers no incentive for improvements in fire safety so that more potential victims could be saved. It is a simplistically deterministic scheme improperly imposed upon a stochastic reality. The time period required for individuals to escape from fire cannot sensibly be expressed by a single number. Instead, there is a distribution. A fraction of persons encountering fire will indeed respond as well as a robot and athletically and single-mindedly propel themselves outdoors. At the other extreme are persons who would take forever, e.g., a bed-ridden invalid with no available rescuers. But in between these two extremes is a very wide range of behaviors and required egress times. Any rigidly-set criterion number, unless so large as to capture everything but the extreme tail of the distribution, will unnecessarily sacrifice individuals who could otherwise be saved.

A stochastic distribution cannot be properly represented by a single value picked from the population. In the RSET/ASET scheme, the situation is actually even worse, since the final results are presented as categorical (i.e., yes/no) rather than quantitative. If RSET is assumed as = 100 s and there are two alternative design choices, one giving ASET = 105 s and the second ASET = 1000 s, under the RSET/ASET scheme these two designs are deemed identical, since in both cases 'ASET > RSET' is Yes. Thus, two designs that are obviously exceedingly different in practice get treated incorrectly as identical. It is not difficult to report the actual test result numbers and to allow a comparison to be made of alternative technologies.

It is especially misleading when RSET/ASET analyses are reported using low RSET values. Canadian researchers have shown that RSET = 11 min (using the definition that RSET starts at time of alarm) may sometimes need to be considered even if individuals are healthy and not handicapped. It also bears emphasizing that, in this research, they did not include counterproductive behaviors, which would greatly increase this time period.

The RSET/ASET concept ignores that the same building + fire protection features may experience vastly different RSET and ASET values, simply because a different fire scenario is used, indicating that these variables have no true or unique value. A fire may occur when occupants are awake (typically a small RSET), or when they are asleep (potentially a large RSET). If the victim is intimate with a flaming fire, ASET might be zero, while with a smoldering fire, ASET may be 30 minutes or more. Even flaming fires vary greatly in their characteristics. In an ultra-fast fire, untenable conditions might be reached in 60-90 seconds while in a moderately fast growing fire, untenable conditions might not occur for 6-9 minutes.

The consequence of using the RSET/ASET concept for fire safety engineering or product design purposes is that fire deaths and injuries are permitted to occur which are preventable. The evaluation of all life safety warning systems, including smoke detectors, should be based on the earliest possible warning of the presence of a fire. The use of RSET/ASET analysis will not achieve this objective; therefore, such analysis should not be used as a design methodology by design professionals, nor by detector manufacturers.

It is recommended that the RSET/ASET concept be abandoned and that egress analyses be properly reported on a comparative 'Margin of safety' basis. This applies not just to design work, but also to experimental research projects. The research required to obtain the data is invariably extensive and costly, so it is inappropriate to take shortcuts and oversimplify the findings so that the benefits are lost and fire safety is needlessly sacrificed. A 'Margin of safety' analysis constitutes a safety-conscious methodology which aims to deliver the maximum escape time that can be physically and economically provided.

Standards and guidance documents which are based on the RSET/ASET concept should be revised to provide adequate life safety for individuals who do not respond to fire circumstances in a robotic fashion. This process is already starting to happen. Utilizing the 'Margin of Safety' concept and realistic assumptions regarding occupant behavior, and fire scenarios several governmental bodies [34][35][36] and fire safety organizations [37][38] are starting to espouse the use of photoelectric technology, as opposed to ionization. It is hoped that the present paper stimulates this effort.

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October 24, 2013

To our brother and sister firefighters from the great FDNY and the responsible legislators from the great City of New York, New York:

I write to you today on behalf of North Eastern Ohio Fire Prevention Association (N.E.O.F.P.A.). Our Association represents approximately two hundred passionate career and volunteer fire prevention professionals from a ten county area from North Eastern Ohio including Cleveland, Ohio. We would like to thank FDNY and the New York City Council for studying this critical smoke detector issue. For in 2012, eighty-three percent of the civilian fire fatalities across this great nation occurred in their private residences where they should feel the safest. All of us in the fire service have one primary mission: TO SAVE LIVES! Today, with the legislation that you are considering before you, you can and will have a great impact on your fire loss statistics, most notably when it comes to fire related deaths and serious injuries with the decisions you make.

There are many topic experts that you have or will be hearing from today, who like us in the fire service have one mission: TO SAVE LIVES! These men and women have either had their lives permanently changed by the loss of a close loved one or have been impacted by fire related deaths in their professional careers as firefighters. As fellow fire service professionals, we respectfully ask our respected peers at FDNY and the legislators from New York to keep an open mind as they share their factual information with you for each of them - Mr. Dean Dennis, Deputy Chief Jay Fleming, Retired Captain Russell Ashe, Adrian Butler, and Valarie Rivett – have very valuable information that has truly changed our minds about smoke detectors in North Eastern Ohio.

For most of us fire prevention professionals in North Eastern Ohio, our lives and careers were positively impacted and changed over three years ago when we first met Mr. Dean Dennis and Mr. Doug Turnbull. These two civilian fathers shared the stories of losing their respective daughters Andrea & Julie to off campus housing fires at The Ohio State University on Palm Sunday of 2003 and Miami University in Oxford, Ohio on Palm Sunday in 2005. At a seminar we hosted, we heard the stories on how these two tragic fires took the lives of eight aspiring coeds at the prime of their lives. There were two dozen working ionization smoke detectors in these two homes, of which only one sounded, which allowed one individual to jump from a second floor window to safety in the Miami fire. Otherwise the other 23 smoke detector units remained silent, taking the lives of the other eight occupants. Because of these two events that were shared by Mr. Dennis and Mr. Turnbull, we started to closely look at and researched the smoke detector issue.

At a second seminar we hosted on the smoke detectors, retired Captain Russell Ashe from the City of Barre, Vermont drove to Ohio to share the tragic story of how ionization smoke detectors failed to activate taking the lives of four children and their mother just before Christmas in December of 2005.

Once again, working ionization smoke detectors failed to alert a family that was sound asleep in their home.

Sadly, as fire service administrators and front line firefighters, we learned more about the critical difference in the types of smoke detection technology in the residential market today – namely ionization, photoelectric, and dual technology (photoelectric and ionization in one unit) - by two fathers who lost their daughters than we ever did from any of the lead fire service agencies. So over the last three years or so, our executive board and membership have done our due diligence to extensively research this smoke detector issue to learn more about smoke detectors in general and what types are on the market, with the pros and cons of each type. Yes, we went back to research the most basic safety device that we tell our residents to install in their homes to save their lives. Our findings have changed the way that we now educate our residents on how to protect themselves from these potentially tragic fire events. After all that research, reading many published studies and talking to many industry professionals and experts, we now feel it is of the utmost importance to teach our residents about the importance of photoelectric smoke detectors to help better protect them and their loved ones who live with them.

We like to compare the smoke detector issue to the seatbelts in automobiles. We started out with a lap belt, progressed to a lap belt with shoulder strap, to a single airbag coming from the steering column. Now we can buy automobiles that have a dozen or so airbags dropping all around us to protect us from a crash. Just like the automobile industry has changed over time, so has the smoke detector industry to the point that the two major manufacturers, Kidde and First Alert early in 2013 have both introduced new photoelectric smoke detector lines knowing that photoelectric technology is the way of the future.

It has now become a very important mission of NEOFPA to educate our fellow peers in the fire service as well as the citizens that we protect, on the importance of photoelectric smoke detector technology TO SAVE LIVES! So we have even created a website www.photoelectricsaves.com to spread the word about these life saving devices and even created a new mascot to help spread the message. His name is EARL LEE WARNING, a caped smoke detector man to help educate especially our younger families that are especially vulnerable to these tragic fires. Our primary video on the front page of our website is from Jeff Rossen of the NBC Today Show based in your New York City who very accurately compiled a six minute segment on smoke detectors. If one of your presenters today does not show it, we would strongly encourage each of you to review it. It can easily be found at a link at our above website.

Here are a few reasons that we support photoelectric technology in residential homes:

- The manufactures recommend it on each one of their smoke detector packages:
    - First Alert - FOR MAXIMUM PROTECTION: Use both types of smoke alarms in every bedroom and on every level of your home.

  - Kidde – Kidde strongly recommends that both ionization and photoelectric smoke alarms be installed to help insure maximum detection of the various types of fires that can occur within the home.
- The fire alarm industry professionals that protect the highest risk hazards in our communities, that is, hospitals, nursing homes, hotels, and the like switched to photoelectric technology a couple of decades ago with great success. Rarely do you hear about a fire related death in those occupancies.
- NFPA 72 references photoelectric technology in their most current standard.
- Photoelectric technology has reduced the number of nuisance alarms. Ionization detectors are commonly taken down or disabled due to nuisance alarms from invisible smoke from cooking and steam from showers
- Published studies show photoelectric technology fails much less frequently than ionization technology.
- Ionization smoke detectors have generated numerous complaints to Consumer Product Safety Commission and generated many wrongful death lawsuits.

Everyone wins when we start working together to educate consumers on the importance of photoelectric technology smoke detectors.

- Residents are alerted quicker to the fire in its' early incipient stages, getting them out earlier saving many more lives. (Statistics from the City of Boston proves this – See Tale of two cities at www.photoelectricsaves.com)
- The fire service gets notified of the fire in a more timely fashion, getting our firefighters to the scenes earlier, minimizing our risks.
- The insurance industry wins because we get to the job earlier, minimizing the structural and contents loss, which ultimately in time may reduce our insurance premiums.

Once again, on behalf of the executive board and membership of North Easter Ohio Fire Prevention Association, thank you for researching this critical smoke detector issue. We truly believe that through a joint effort of the fire service, in conjunction with our civic leaders, we can make a more positive impact TO SAVE LIVES with photoelectric smoke detector technology in residential homes.

Respectfully,

John C. Desmarteau
President

FOR THE RECORD

TESTIMONY

By

Joseph M. Fleming
Deputy Chief
Boston Fire Dept. (MA)

Int. No. 1111 – Article 312, Carbon Monoxide and Smoke Alarms

And

Int. No. 865 – Law Requiring Photoelectric Smoke Alarms

Submitted to the New York City Council
Committee on Housing and Buildings

October 24th, 2013

Comments Regarding Int. No. 1111

I applaud the City of New York for taking steps to increase the probability that smoke alarms will be operational long after they are installed. However, I would like to point out the following information which indicates a way to improve the legislation, based on our experiences in Boston.

It leads to the conclusion that even with ten-year batteries, most smoke alarms will still be disabled in just a few years. The number one reason that occupants disable smoke detectors is due to nuisance alarms. If a ten-year smoke alarm uses ionization technology, the evidence indicates that it is still likely to be disabled. If the battery cannot be removed then the smoke alarm will just be removed from the ceiling. The current technology that addresses the nuisance alarm problem in the most effective manner is photoelectric technology.

What do the scientific studies show regarding the usefulness of ten-year batteries?

Several studies have shown that even with ten-year batteries most smoke alarms will be non-operational just a few years after installation. Here is a quote from reference #2.

> *However, the efficacy of OI seems to have dropped during the second 5 years of follow-up. There was a marked difference in incidence case rates between the first 5 years and the second 5 years in the programme population, with an apparent change in the cumulative incidence curve at about 6–7 years. This may have been due to non-functioning of smoke alarms over the years. Although lithium-powered alarms are supposed to function for 10 years, it was apparent from our follow-up testing that they do not. Although >90% of the programme houses had at least one working smoke alarm at the 2-year follow-up sample,* ***that proportion was down to 20% for the 10-year sample.*** *This is similar to the findings of Jackson et al, (Reference #1) that* ***only about one-third of lithium-powered smoke alarms were still functioning after 10 years.***

In both of these studies, the smoke alarms were ionization, which probably explains why so many were disabled. **As a consequence, a huge improvement to this legislation at little or no cost increase would be to require that these alarms be photoelectric.**

What do the manufacturers recommend?

In the United Kingdom, Kidde, which also sells alarms in the US, provides photoelectric smoke alarms with ten-year batteries to fire brigades. (See reference #3.) Here is a quote from that link –

> *Kidde's new product was designed with features that take into account feedback obtained from Fire Brigades in the UK & Eire, plus Social Housing Providers. Initial feedback from customers shown the new product has been very encouraging.* ***In line with current trends the alarm is available only in an Optical configuration.*** *(Note "optical" means photoelectric.)*

In the US, this same manufacturer, i.e. Kidde, explains why their new "worry-free" ten year alarm uses photoelectric technology.

> The "Worry Free Alarm uses *"**a photoelectric smoke sensor programmed to reduce nuisance alarms.** Certain municipal codes require that a smoke alarm installed near a kitchen use a photoelectric sensor to reduce nuisance alarms associated with cooking. Kidde's Worry Free line meets these requirements.".*

Another US Manufacturer, First Alert, describes one of their ten year smoke alarms with the following language.

> *"**Long Life Photoelectric Sensor Smoke Alarm** - This long life battery operated smoke alarm uses a lithium battery that is warranted to last 10 years. **The photoelectric smoke sensing technology reduces nuisance alarms from cooking smoke and shower steam.** Mute feature silences nuisance alarms from cooking smoke or shower steam. Single button also tests alarm functions. Easy access battery drawer: no need to remove alarm from ceiling to change battery. 10-year limited warranty. Meets UL standards.*

What does the International Association of Fire Chiefs (IAFC) say?

> THE IAFC recommends *"installation instructions which state **that ionization alarms need to be spaced further away from fixed cooking appliances than photoelectric alarms to avoid nuisance activations"**.* The IAFC also recommends that the Public should be educated about, *"**The reasons for locating ionization alarms away from cooking areas and bathrooms (steam from the shower)**"*

In my opinion, relying on public education and "installation instructions" has been ineffective. If there is a clear benefit to using photoelectric alarms near kitchens and bathrooms, why not just legislate it?

What do public health researchers say?

In a paper published in 2000, Alaskan researched concluded the following.

> *"In small rural residences, photoelectric smoke alarms have lower rates of false alarms and disconnection. **Photoelectric alarms may be the preferred choice for dwellings with limited living space or frequent false alarms."***

In 2007 researchers in Washington State concluded the following.

> *"Results suggest that the **selective use of photoelectric alarms by fire injury prevention programs or consumers may provide longer-term protection in similar populations."***

In 2010 Iowa researchers concluded the following.

> ***Photoelectric smoke alarms and lithium batteries are the most likely to function long after smoke alarm installation, and may be worthwhile investments despite their increased cost.***

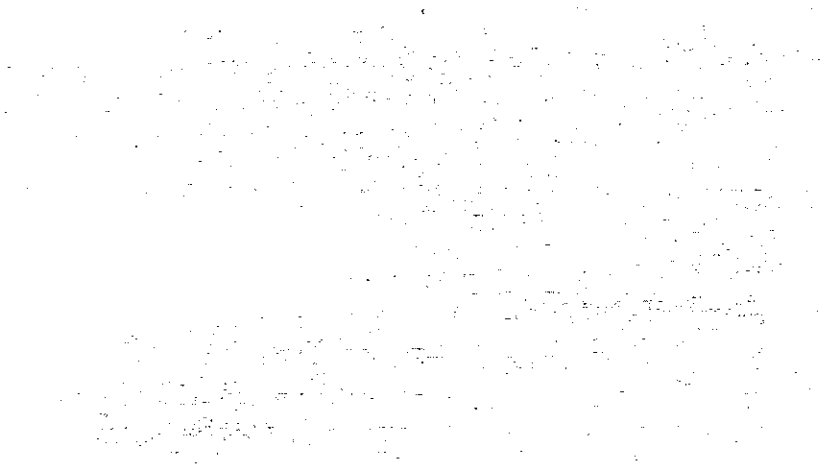
The studies and research would seem to indicate that requiring "ten-year" smoke alarms will mean that after 5 years approximately 50% will be operational and after ten years 25-35% will be operational. By adding the additional requirement that these alarms be photoelectric, the studies indicate that the % of alarms still working after 5 years and/or ten years could be doubled (>75% after ten years) at almost no extra cost.

According to Amazon.com –

Ten Year battery Smoke Alarms

	Ionization	Photoelectric
Kidde	$20.12	**$28.00 ($2.80/year)**
First Alert	$18.00	**$22.62 ($2.26/year)**

Any of these photoelectric alarms would seem to be in the $25 range mentioned in the Mayor's proposal. In addition, the few extra cents per year for the photoelectric smoke alarm is much more cost effective since it has a higher probability of being operational.



Comments Regarding Int. No. 865

Some people characterize the smoke alarm vs. residential fire problem in the following manner:

> *"Because homeowners cannot predict what type of fire might start in a home, for increased protection, USFA (US Fire Administration) recommends installing both ionization and photoelectric or dual sensor, smoke alarms in the home per manufacturers' installation instructions and applicable codes.*

In my opinion there are 2 problems with this logic.

1) It ignores the potential for disabled alarms due to repeated nuisance activations and
2) It assumes that the extra 30 minutes provided by the photoelectric in smoldering scenarios is equivalent to the extra 30 seconds provided by the ionization in some flaming scenarios.

The 1st problem has been previously discussed so I would like to deal with the 2nd "problem." The homeowner may not be able to predict what type of fire might start in a home the USFA should be able to. Keep in mind that we should not be concerned with the entire universe of fires. When discussing smoke detectors, we should be concentrating on the fires that occur while people are sleeping. (Statistics regarding fire type versus time of day are provided in Addendum A.)
In the recent NIST (National Institute of Standards and Technology) Home Smoke Alarm tests the following results were obtained.

NIST ANSWERS TO QUESTIONS REGARDING HOME SMOKE ALARM TESTS

Table 2. Average time to first alarm and time to untenable conditions, with standard deviations.

	Time to First Alarm (s)		Time to Untenable Conditions (s)	Available Safe Egress Time (s)	
	Photoelectric Alarms	Ionization Alarms		Photoelectric Alarms	Ionization Alarms
Smoldering Fires	2219 ± 1061	4010 ± 1120	4244 ± 1265	2064 ± 950	197 ± 336
Flaming Fires	97 ± 31	47 ± 35	216 ± 68	124 ± 64	175 ± 70
Cooking Fires	738 ± 103	688 ± 476	1464 ± 255	688 ± 476	777 ± 244

For the NIST test series, the average ASET (assuming placement of detectors in all rooms) for ionization alarms ranged between 175 s for flaming fires and 197 s for smoldering fires; for photoelectric alarms the ASET averaged between 125 s and 2064 s. For the purpose of the *Tech Beat* article, 180 s (or 3 minutes) was selected as representative of the amount of time available, and to convey to the reader the importance of leaving their residence quickly after first hearing a smoke alarm of any design.

This data was used to justify the following NIST Summary: *"According to the two-year NIST home smoke alarm performance study, ionization smoke alarms respond faster to flaming fires, while. The report concluded that, despite these differences, the placement of either alarm type on every level of the house provided the necessary escape time for the different types of fires examined."*

I would like to comment on this "Summary."

1. " ionization smoke alarms respond faster to flaming fires"
   - This is true but misleading. In the most common type of flaming fire, i.e. the cooking scenario, while the ionization is faster the photoelectric is still on average providing > 10 minutes escape time. In the very fast growing "flaming fires" the ionization is once again faster but the photoelectric is still providing, on average >2 minutes escape time. In many cases occupants are awake during these types of scenarios.

2. *"while photoelectric smoke alarms respond quicker to smoldering fires"*
    - This is true, but while, "quicker" = 30-50 seconds earlier, "quicker" now means 30 – 50 minutes. More importantly in many smoldering scenarios the ionization is providing negative escape time, indicating that occupants would not be able to get out of the house safely, particularly since they are likely to be sleeping and relying on the smoke alarm to alert them.
3. *" The report concluded that, despite these differences, the placement of either alarm type on every level of the house provided the necessary escape time for the different types of fires examined."*
    - NIST could have just as easily concluded that **in the most likely scenario to occur while people are sleeping, i.e. the smoldering scenario, the ionization smoke alarm will often fail to provide necessary escape time.**

Here are quotes from others who have commented on this topic.

Source 1 - *"Application Specific Sensitivity: A Simple Engineering Model to Predict response of Installed Smoke Detectors,"* (Jensen G. et al., Interconsult Group ASA paper at Aube 1999).

"It is recognized that deadly fires and fires doing the most damage typically have a substantial undetected incipient stage while flame-ignited fires are typically intimate with awake people and connected to their activities. ***Hence, detection in order to alert is less important (in flaming fires).*** *Reference - Building Fire Statistics 88-97 Norway. Directorate for Fire and Explosion Prevention.*

Source 2 – Home Office, United Kingdom Fire Statistics 1983, London (1983).

"The data broke the fire into two types. Fires estimated to have been discovered within 5 minutes of ignition (most likely to have been rapidly growing flaming fires) and for fires where the time to discovery is estimated to have been 30 minutes or more (most likely to have involved a period of prolonged smoldering before severe flaming). The preliminary data show that there were 23,082 fires in the first category, but only 4 fatalities, while for the second category there were fewer fires (5,870) but 20 fatalities, a ratio per fire of 1:20. Obviously, a number of interpretations could be put on this data, but it does seem that people in this active age group are able to escape from rapidly growing fires in domestic-sized compartments. ***Fatalities are much more likely in fires that have undergone a period of prolonged smoldering, when victims may have been overcome by prolonged, low level exposure to narcotic fumes. If this is the case, perhaps there should be more concern about the ability of materials to continue smoldering, with toxic gas buildup over a long period of time, at least in the context of this class of fire."***

Source 3 - *"Detection of Smoke - Full Scale Tests with Flaming and Smouldering Fires, "Fire Safety Science,"* - Proceedings of the Third International Symposium, July, 1991,)

The advantage of ionization smoke detectors during flaming fires is only about a 15-20 second earlier warning. ***This margin will only be decisive for the loss of human life in extraordinary circumstances.*** *In general the difference between the alarm times for the optical and the ionization detectors are reduced when the detection is made from an adjacent room. This can be related to the fact that particles in the smoke tend to coagulate (smoke aging).*

Source 4 - "*A Decade of Detectors*", Fire Journal 09/85, John Hall (NFPA)

> *Delayed discovery, typically associated with fires that occur at night when everyone is asleep, also tends to be a characteristic of the smoldering fire caused by discarded smoking material.* ***These smoldering fires are the leading causes of US fire fatalities*** *and detectors are ideally designed to deal with them.*

Source 5 – Australasian Fire Authorities Council - Position on Smoke Alarms in Residential Accommodation (June 2006).

> *Current research indicates that:*
> - *ionisation smoke alarms detect flaming fires marginally earlier than photo-electric smoke alarms.*
> - *photo-electric smoke alarms detect smouldering fires and fires starting in areas remote from smoke alarms significantly earlier than ionisation smoke alarms.*
> - ***ionisation smoke alarms may not operate in time to alert occupants early enough to escape from smouldering fires.***
> - ***for both flaming fires and smouldering fires, photo-electric smoke alarms are likely to alert occupants in time to escape safely.***

Source 6 – International Association of Fire Fighters (IAFF) Convention Resolution (2008).

- *current research indicates that* ***ionization smoke alarms detect flaming fires marginally earlier than photoelectric smoke.***
- *photoelectric smoke alarms detect smoldering fires and fires starting in areas remote from smoke alarms* ***significantly earlier than ionization smoke alarms; and, ionization smoke alarms may not operate in time*** *to alert occupants early enough to escape from smoldering fires*
- ***many fires in residential occupancies begin as smoldering fires, particularly when occupants are sleeping,*** *photoelectric smoke alarms provide more effective all-around detection and alarm than ionization alarms;*

Source 7 – Mass. Building and Fire Code Joint Committee on Smoke Alarm Technologies (2007)

> *(4) Photoelectric type smoke detectors are, in general, as effective as or only slightly less effective than ionization type smoke detectors for detection of flaming fires in terms of time to detection and warning of comparable smoke conditions.*
> *(5) Photoelectric type smoke detectors are significantly more effective in providing earlier detection and warning than ionization type smoke detectors in smoldering fires.*
> *(6) Smoldering fires cause a significant percentage of deaths and injuries due to fires in the Commonwealth per year.*
> ***(7) Based upon the foregoing, the use of working Photoelectric smoke detectors should provide an earlier warning to occupants of a building involved in smoldering fires, therefore providing an enhanced level of safety and a potential reduction in fire deaths and injuries in the Commonwealth.***

I think it is interesting, and extremely suggestive, although not conclusive, that since the mid 90's when the Boston Fire Department and then Massachusetts started to advocate for the installation of photoelectric technology the fire death rate has gone down at a much faster rate than the US as a whole.

Average Number of Fatalities per Year/Per Decade (NFPA)
(# in parenthesis indicates % reduction from previous decade.)

	Boston	**US**
1973 – 1982	28.3	6984
1983 – 1992	15.9 (-44%)	5502 (-20%)
1993 – 2002	11.2 (-29%)	4131 (-26%)
2003 – 2012	3.2 (71% less)	3063 (-26%)
Total % Reduction (73-82) to (03-12)	**89%**	**56%**
Population Changes 1980 - 2010	562K – 625K (+11%)	226M – 309M (+36%)

Assuming that it takes a few years from the adoption of a new regulation to make an impact, any impact of new smoke alarm regulations should start about 5 years after adoption. Boston and Massachusetts adopted smoke alarm regulations earlier than most states, which may explain why the decrease in Boston was faster than in the US from (83-92). The gradual adoption in other states in the mid-late 80's may explain why the reduction in the 90's was essentially the same. Starting in the early 2000's the fatality rate in Boston (deaths per million population) decreased at a rate almost 3 times faster than the US as a whole. While many factors probably contributed to this reduction we feel that the use of photoelectric smoke alarms was a major contributor

While no smoke alarms is 100% effective at detecting fires and being resistant to nuisance alarms, the photoelectric smoke alarms has been shown in repeated studies to be the best smoke alarm for a residential setting. **We would suggest that New York City follow the lead of other cities and states and mandate the use of photoelectric smoke alarms.**

2 Final points

1. It is illogical to claim that all alarms perform similarly because they are all required to pass UL217 (Underwriters Labs Smoke Alarm Standard). I sit on the Committee and have gradually convinced the industry dominated group to admit that UL217 does not adequately tests for smoldering smoke from synthetic material commonly found in the home and does not have an adequate means to tests for resistance to nuisance sources. As a consequence, this Standard does not test smoke alarms in a manner that would recognize the benefits of photoelectric technology. (It may be a coincidence that this would have been inconvenient for many of the manufacturers who dominate the committee.)
2. Dual Alarms (Ion/Photo) are not as beneficial as one might assume. 1) I am not aware of a dual that comes with a ten year battery. 2) Because it contains an ion element studies show it to be just as susceptible to nuisance sources as stand-alone ionization. 3) It may be superior to a photoelectric in flaming fires, assuming that the different sensing mechanism are not de-sensitized but as pointed out earlier the slight advantage in flaming fires is of very little benefit in most fires.

Sincerely,

Joseph M. Fleming, Deputy Chief
Boston Fire Dept.

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Jayf.bfd@ci.boston.ma.us

References
(All have been previously supplied to the Council.)

Bill No. 1111

1. *"Evaluation of the "10-Year" Smoke Alarm Project,"* The US Centers for Disease Control and Prevention: J. Wilson, J. Akoto, S. Dixon, and D. Jacobs, October 7, 2008.
2. *"Preventing deaths and injuries from house fires: an outcome evaluation of a community-based smoke alarm installation programme,"* Istre, G. et al, Injury Prevention, July 19, 2013.
3. Kidde Ten4 Optical Smoke Alarm with ten year battery, http://ten4.kiddefyrnetics.co.uk.
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5. First Alert Website - http://www.firstalertstore.com/store/products/sa710lcn-photoelectric-sensor-smoke-alarm.htm
6. IAFC Position on Smoke Alarms, - http://www.iafc.org/files/1ASSOC/IAFCposition_UseOfResidentialSmokeAlarms.pdf
7. FDNY 2008 Press release - http://www.nyc.gov/html/fdny/html/events/2008/101208a.shtml
8. *"Ionization and photoelectric smoke alarms in rural Alaskan homes,"* West J Med, 2000;173:89-92
9. *"Randomized controlled trial of ionization and photoelectric smoke alarm functionality,"* Injury Prevention 2008;14:80–86.
10. *"Smoke Alarm and Battery Function 42 Months After Installation - A Randomized Trial,"* (Am J Prev Med 2010;39(4):368–371).

Bill No. 865

11. NIST Answers to Questions regarding Home Smoke Alarm Test (2007)
12. NIST Home Smoke Alarm Study (2004, and revised 2008).

Other references are cited in the body of the document.

ADDENDUM A

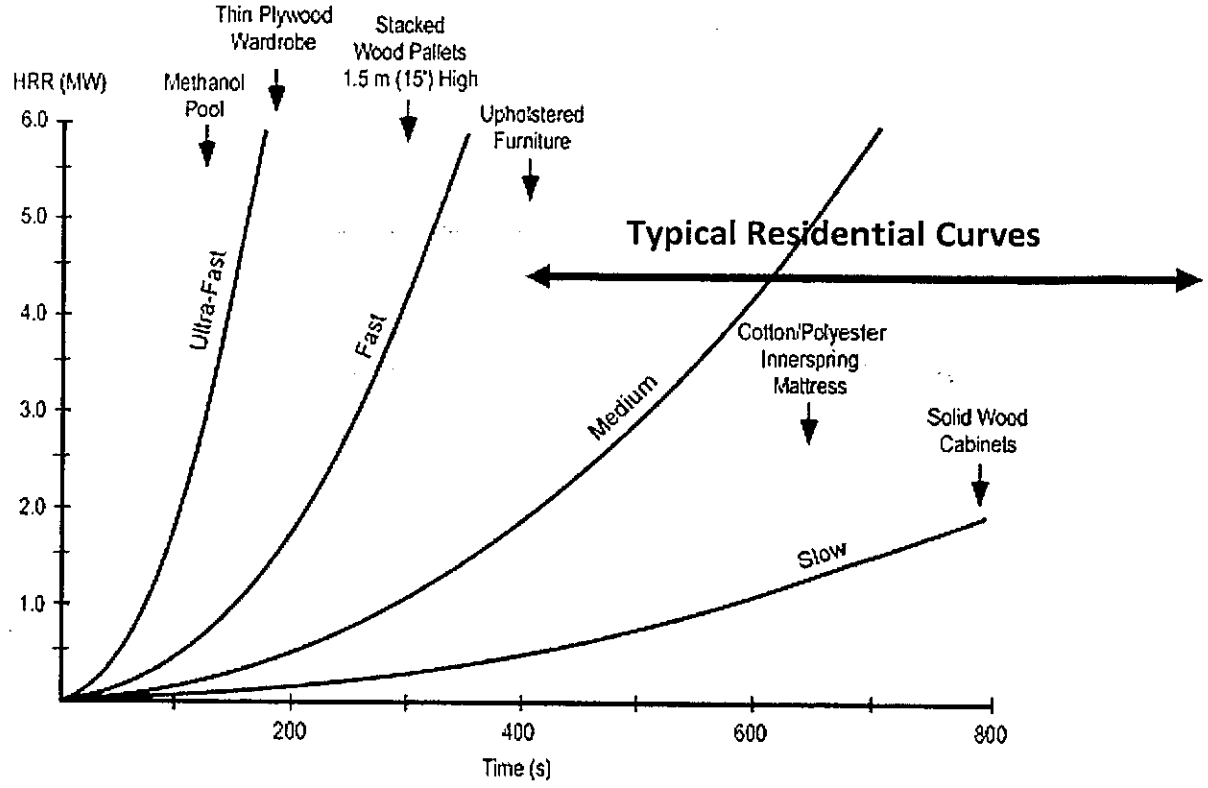
WHAT TYPE OF FIRES, I. E. SMOLDERING OR FLAMING, SHOULD SMOKE ALARMS PROTECT AGAINST?

There are 3 factors to consider when comparing smoke alarm response time to fire type;

1) Is the fire flaming or smoldering,
2) If the fire is flaming, what is the growth rate, and
3) Is the victim sleeping or awake?

Smoldering fires start out in a non-flaming mode, during which smoke is produced with little heat. Most eventually convert to the flaming mode, at which time they behave like a typical flaming fire. The time at which the fire converts to the flaming could be 20 minutes to several hours. It appears that the median time for this to occur is about 1 hour. The longer the fire smolders the more likely that dangerous levels of CO and smoke may develop during the smoldering phase.

Flaming fires start out in the flaming mode, but depending on the ignition scenario and material burning flaming fires can have very different growth rates (see below). The typical residential growth curves are in the slow – medium range. If a candle or open flame is used to ignite upholstered furniture it may produce a medium –fast fire growth. Flammable liquids or dry Christmas trees would produce an ultra-fast fire.



According to data from 2003 – 2007 (NFPA), the percentages of residential fire deaths implicated by various ignition sources were: smoking materials at 25% (presumably initially smoldering fires), candles at 6% and playing with heat source at 4% (both presumably initially flaming fires), heating equipment at 22%, electrical distribution and lighting at 12%, intentional at 12%, and cooking at 17%. An unknown fraction of cooking initiated fires occurs during an un-attended phase where smoke alarms may provide the initial warning. Some fraction of heating equipment, electrical distribution and lighting, intentional, and cooking initiated fires start as flaming fires or initially pyrolyze materials for a short time before transitioning to flaming, and some fraction may initiate a long smoldering phase. While the exact fraction is unknown, both initially flaming and initially smoldering fires are implicated in residential fire deaths; therefore, smoke alarms must provide adequate warning to both flaming and smoldering fires. However, it appears that some scenarios play a much more important role.

US FIRE STATISTICS FOR THE TIME PERIOD 2003-2007					
	Comment	**% Smoldering - ?**	**% Fast Flaming**	**% Slow – Medium Flaming**	**%Smoldering**
Smoking (25%)	Small % intimate while on oxygen – most smoldering	*Assume 95%*	N/A		2 4%
Heating (22%) *Slow-medium*	Some Flaming/ Some Smoldering	*Assume ½*		11%	1 1%
Cooking (17%) *Slow – medium*	Some Intimate (7%?) Some while occupants sleeping			10%	
Electrical (12%) *Slow – medium*	Some Flaming/ Some smoldering	*Assume 1/2*		6%	6%
Arson (12%)	Intimate – Ignore	*Assume Zero*	N/A	N/A	N/A
Candles (6%) *Medium - Fast*	All Flaming	*Assume Zero*	6%		
Playing with heat Source (4%)	Intimate – ignore	*Assume Zero*	N/A	N/A	N/A
		Fire Type	6%	27%	1%
		Fire Type (% of all listed above not counting Arson or Intimate)	**8%**	**38%**	**5%**
		What NBS Assumed at Indiana Dunes (mid 70's)		**40%**	**60%**

- These estimates are very similar to the estimate assumed in the mid 70's by federal researchers.
- From 1971 – 1978, 56% of fire fatalities in 1-2 family homes, occurred between 12AM and 8AM.
- From 2207 – 2011, 49% of fire fatalities in 1-2 family homes, occurred between 12AM and 8AM.
- So we should expect to see similar numbers and we do.
- Conclusion: the type of fire that we should be concerned with when thinking about smoke alarms is the type of fire that occurs while people are sleeping. This is primarily the smoldering fire and secondarily the slow – medium growing flaming fire.

BASED UPON NFPA STATISTICS			
	1980 - 1982 %	Recent %	% of Fatalities Between 12AM and 8AM "Recent"
These fires seem to be most dangerous at night (occupants sleeping).			
Smoking (Most Smoldering)	35%	25%	39%
Heating (Slow-medium)	21%	22%	52%
Cooking (Slow – medium)	10%	17%	41%
Electrical (Slow – medium)	9%	12%	54%
Subtotal	**75%**	**76%**	
These fires seem to be most dangerous during the day (occupants awake).			
Candles (Medium – Fast)	2%	6%	25%
Playing with heat Source (Intimate/Fast)	7%	4%	27%
Subtotal	9%	10%	
Arson (Not Applicable)	18%	12%	50%

So while it is impossible to predict the type of fire that will occur in a person's home it is possible to predict which type of fire is likely to occur while victims are typically sleeping. That type of fire will be either a smoldering or slow – medium growing flaming fire. Although it is possible for a fast-flaming fire to spontaneously initiate while all occupants are sleeping that appears to be infrequent and in many cases no smoke alarm provided enough escape time since untenable conditions develop so quickly.

NEW YORK CITY COUNCIL
Committee on Housing and Buildings

Proposed Bills to Amend the Administrative Code of the City of New York relating to Smoke Detectors

Intro 865: Requiring photoelectric smoke detectors in residential buildings
Intro 1111: Requiring expiration-of-useful-life alarms on smoke detectors

Testimony of Chief Thomas Jensen
New York City Fire Department, Bureau of Fire Prevention

October 24, 2013

Good afternoon Chairman Dilan and members of the Council. I am Tom Jensen, and I am the Chief in charge of the Bureau of Fire Prevention for the New York City Fire Department (FDNY).

Thank you for the opportunity to speak with you today about two bills that amend the New York City Building Code relating to smoke detectors. We support Intro 1111, which would require owners to replace smoke detectors when they exceed the manufacturer's suggested useful life, and also require newly installed alarms be equipped with an audible "end-of-life" warning device. We oppose Intro 865, which would require photoelectric smoke detectors in residential buildings and occupancies such as nursing homes, hospitals and hotels.

The FDNY appreciates the Council's concerns regarding fire safety and your efforts to increase awareness about the fire-detection technologies available on the market.

Intro 1111

As you may be aware, Local Law 75 of 2011 required periodic replacement of Carbon Monoxide (CO) detectors in dwellings upon the expiration of the manufacturer's suggested useful life. That Local Law did not include smoke detectors, so Intro 1111 closes the loop regarding replacing out-of-date devices. With this bill, non-working smoke alarms – as with CO detectors – will have to be replaced and newly installed alarms will have to be equipped with audible end-of-life warning signals.

The Fire Department strongly supports this bill: it carries out the intent of NFPA 72, which provides that smoke alarms be replaced after ten years, and will help to save lives.

Intro 865

In accordance with Local Law 26 of 2008, the FDNY is in the process of drafting legislation to update the City's Fire Code to reflect current fire safety standards and

technologies. As with the 2008 Fire Code revision, the FDNY has proposed amendments to the latest edition of the International Fire Code and will submit those proposed amendments -- in the form of a Council bill -- to the City Council for its consideration very soon.

The reason I mention this with respect to Intro 865 is that we would prefer that any dictate – legislative or otherwise – regarding the use of smoke detector technology be promulgated by the experts: the National Fire Protection Association (NFPA) and/or the International Code Council (ICC). We believe that introducing a bill to require a single technology -- photoelectric as opposed to ionization -- at this time is premature.

We are not the experts and do not have the resources to do extensive research, but we do look to the experts before we make changes to the City's Fire and Building Codes. We have reviewed the research on smoke detector technologies and do not believe there is a universal consensus about the superiority of photoelectric -- in the circumstances called for in the bill -- to justify our support. Until the research is more conclusive about the preferred technology, and either the NFPA and/or ICC make that determination, we would not support a bill mandating the use of one technology over the other even to the extent it is circumscribed in Intro 865.

When we propose revisions to the Fire Code, and when DOB proposes changes to the Building Codes, we rely on the respective model codes and national experts for guidance. By proposing Intro 865, the sponsors are not relying on clearly established research or uncontroverted findings of experts in the field.

The goal of the FDNY is to make sure ***every*** home has a ***working*** smoke alarm. It is our continuing mission to provide education about the dangers of fires, and the actions the public can take to ensure their safety. Taken together, these will lead to safer homes, and fewer injuries and fatalities due to fire.

When we *are* asked about smoke alarms, we have expressed support and preference for dual alarms (combined photoelectric and ionization smoke alarms), in line with current NFPA recommendations, especially when they are outfitted with alarm-silencing devices that can be activated when there is a false alarm.

Research has shown that each smoke alarm technology has unique advantages under certain fire conditions. As you know, photoelectric alarms are most reliable for smoldering fires, which may occur in bedrooms or sitting rooms; ionization-type alarms are the most reliable for flaming fires, which may occur in the kitchen.

While some municipalities and states have legislated the use of photoelectric in certain circumstances, we do not think the issue is ripe or the evidence conclusive. The NFPA cautions that technology is still evolving and studies are being conducted.

According to a recent Underwriters Laboratory report[1]:

> The key challenge in selecting the appropriate smoke alarm technology is the inability to predict the type of home fire that is likely to occur. For that reason, nationally recognized fire safety organizations including NFPA, USFA, International Association of Fire Chiefs, NIST, National Association of State Fire Marshals ... and UL all currently recommend the use of both photoelectric and ionization smoke alarms in residential settings, or the use of smoke alarms incorporating both types of these sensing technologies in a single device ....

Lastly, notwithstanding our general concerns about the prematurity of Intro 865, we also find it curious that the bill's provisions include hospitals, prisons, assisted living facilities and other residential institutions. These occupancies usually have complex fire detection and alarm systems designed by engineers. New technology is being developed every day. We think that the engineers designing these systems should be able make professional judgments about what smoke detector technology to install and not be limited by strict Building Code provisions that would become law if Intro 865 is enacted.

Conclusion

You will hear shortly from the NFPA and other experts. They will provide their opinions on the bills and the technology. The FDNY remains open to hearing all sides. That is our job. And we are open to continuing discussions with the City Council. But, for now, we would not lend our support to Intro 865 for all of the reasons I have just stated. And, we fully support Intro 1111.

I thank you again for your support for fire safety in New York City, and for the opportunity to speak with you today about the proposed legislation.

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National Fire Protection Association

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Testimony of John D. Caufield (National Fire Protection Association) to the City of New York Committee on Housing and Buildings regarding:

- Introductory 865 - *in relation to requiring photoelectric smoke detectors in residential buildings.*
- Introductory 1111 – *in relation to smoke alarms*

October 24, 2013

Good Afternoon, my name is John D. Caufield; I am the Mid-Atlantic Regional Director for the National Fire Protection Association (NFPA), and the retired Fire Chief from the Rochester (NY) Fire Department, where I served for almost 27 years. I thank you for the opportunity to offer testimony relating to Introductory Items 865 and 1111, both of which seek to amend the administrative code of the City of New York regarding smoke detectors.

Introductory item 1111

This introductory item addresses items related to the replacement of smoke detectors and carbon monoxide alarms at the conclusion of their service life. Introductory item 1111 is consistent with NFPA's National Alarm Code (NFPA 72, 2013 ed.) which recommends replacement of smoke detectors and carbon monoxide detectors when such units reach the age of 10 years.

As Introductory Item 1111 is consistent with NFPA 72, I support this item.

Introductory 865

In preparation for my testimony, I reviewed The National Fire Alarm Code (NFPA 72, 2013 ed.), "smoke alarm" reports prepared by committees in Maryland, California and Ohio, technical reports on smoke detectors prepared by *Underwriters Laboratories* (UL), and various fire data reports as compiled by NFPA and the United States Fire Administration (USFA).

As you are aware, the purpose of smoke detection is to sense the presence of "fire" (products of fire combustion) and provide a warning / alert to occupants so they can safely evacuate. While smoke detectors are widely credited with contributing to a significant reduction in residential fire deaths in the United States, equally important factors are: that the occupant knows what to do, and that they are able to physically evacuate.

There are two significant issues related to alerting of occupants: *how quickly does the smoke alarm activate,* and *how much time is available for occupant to evacuate*? Additionally, there are two general types of "fires" (for classification purposes) and two distinct types of smoke-detection technology:

- Flaming / Fast moving - research has repeatedly shown that Flaming or fast-moving fires are detected more quickly by *ionization* type smoke detectors.

- Smoldering fires - which studies have shown, are more quickly detected by *photoelectric* smoke detectors.

For more than 30 years, fire service professionals and researchers have conducted studies and convened several different task groups, each trying to determine the most effective type of smoke detector technology. Each study or task group has come to the same general conclusion: there is no single detector technology that always performs best. To summarize, the type of fire determines which sensing technology works best. Further, there is no evidence-based research or findings that support the use of solely photoelectric detection technology to the exclusion of ionization detection.

In fact, many leading fire service organizations, including NFPA, International Association of Fire Chiefs, the United States Fire Administration, and others support utilizing both technologies, in a dual-sensing device, to take full advantage of the advantages of both sensing technologies.

The National Fire Alarm Code (NFPA 72) does not endorse one sensing technology over another; it strongly recommends utilizing both ionization and photoelectric technologies to take advantage of the strengths of each type of detection. Additionally, NFPA 72 contains several recommendations, including interconnected smoke detectors, which would enhance the protection offered by existing smoke detector requirements.

Finally, there is on-going research and development directed toward developing new technologies and devices; Introductory 865 would prohibit adoption of developing technologies. To conclude, I cannot support Introductory Item 865, as it conflicts with the recommendations and findings of numerous studies, is not based on any evidence-based research, and prohibits the adoption of new detection technologies.

I thank you for the opportunity to testify on this important public safety item, and welcome any questions.

References:

1. Smoke Alarms in US Home Fires (Ahearns, 2011) http://www.nfpa.org/research/statistical-reports/fire-protection-systems/smoke-alarms-in-us-home-fires
2. Maryland Smoke Alarm Technology Task Force – Final Report (August 2012) https://www.mdsp.org/LinkClick.aspx?fileticket=-XeJdci2rdw%3d&tabid=580&mid=1538
3. Smoke Alarms and the Modern Residence Fire: Recent Studies and Research at UL (Fabian, 2011) http://www.ul.com/global/documents/offerings/perspectives/regulators/SmokeAlarmsInModernResidences.pdf
4. California State Fire Marshal Smoke Alarm Task Force – Final Report (2011) http://osfm.fire.ca.gov/firelifesafety/pdf/Smoke%20Alarm%20Task%20Force/CSFM%20SATF%20Report%208-16-11.pdf
5. NFPA 72 (2013 edition) available at www.nfpa.org
6. Smoke Alarm presence & performance in US Home Fires (Ahearns, 2010) http://www.nfpa.org/~/media/Files/Research/smokealarmpresenceandperformanceinus.pdf
7. Home Structure Fires (Ahearns, 2013) http://www.nfpa.org/research/statistical-reports/occupancies/home-structure-fires
8. Multiple-fatality Fires in Residential Buildings (2009-2011) http://www.usfa.fema.gov/downloads/pdf/statistics/v14i6.pdf

CALIFORNIA REAL ESTATE INSPECTION ASSOCIATION

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October 23, 2013

Council Member Elizabeth S. Crowley
Committee on Housing and Building
250 Broadway, Suite 1765
New York, New York 10007

RE: INT 865

Dear Council Member Crowley and Esteemed Co-Sponsors

I am David Pace, Chairman of the Board of the California Real Estate Inspection Association (CREIA). CREIA strongly supports INT 865. This ordinance will require photoelectric smoke detectors in residential buildings. In January 2011, out of a conviction that Photoelectric Smoke Detectors/Alarms will save the lives of residents, fire fighters and other first responders, CREIA adopted the following position:

> The California Real Estate Inspection Association's Official Position is to:
> Recommend ONLY Photoelectric Smoke Detectors/Alarms
>
> RESOLVED, That CREIA support the mandate of only photoelectric smoke detectors in California law and in all standard development organizations' building fire and life safety codes and standards.
>
> That CREIA support the installation of only photoelectric smoke detectors in all residential housing. And that CREIA does NOT Recommend Combination Alarms
>
> WHEREAS, dual alarms, also known as combination alarms, contain both technologies are available, the benefit over photoelectric in the response to fires is marginal. They are more costly, and they will experience the same nuisance problem as ionization smoke alarms.

As you know, almost all U.S. homes have ionization technology smoke alarms. Decades of research clearly show that ionization alarms are ineffective in real-world fatal fires. On the other hand, many scientific studies demonstrate that photoelectric technology smoke alarms in residential will save more lives. CREIA feels Ordinance INT 865 will reduce fatalities and other serious injuries and have national implications, serving as a model for other cities to follow

CREIA was founded in 1976 and is one of the oldest and most respected home inspection organizations in the United States. CREIA is committed to working for changes in health and safety laws and building codes to require the use of photoelectric alarms around the country.

CREIA supports your efforts to require the use of photoelectric alarms. When adopted, this ordinance will significantly reduce the number of fire deaths in New York City. CREIA applauds the courage of you and the Co-Sponsors in championing this ordinance.

Respectfully,

David R. Pace
CREIA Chairman of the Board, 2013-2014

The ionization and photoelectric smoke alarm trigger times are summarized in Table 25.

Table 25 – Non-flaming mode alarm response times

Target Sample Description	Test No.	Ion Alarm Trigger Time (s)	Analog Signal Value		Photo Alarm Trigger Time (s)	Analog Signal Value	
			MIC (pA)	Photo (mV)		MIC (pA)	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	74.5

43 min DIFFERENCE TRIPPED ABOVE 10% MAX SMOKE LEVEL

Note to Table 25:
DNT = Did not trigger

For the Ponderosa pine test sample, the photoelectric smoke alarm on an average triggered 2.3 % faster than the ionization smoke alarm. For bread the ionization smoke alarm was 22 % faster than the photoelectric smoke alarm. For most of the other test samples the ionization smoke alarm did not trigger. In each of these cases an OBS of 10%/ft had not been reached. For the one case where the ionization alarm did trigger (PU foam test series 12261), an OBS of 10 %/ft was attained. In the case of the two tests (polyisocyanurate foam, PU foam) for which neither the ionization nor the photoelectric alarm triggered, this may be due to the smaller test sample mass. For the polyisocyanurate foam test the maximum OBS value was calculated to be 0.67 %/ft and for the two PU foam tests the maximum obscurations were 1.82 and 1.98 %/ft respectively. The PU foam tests were repeated with a larger sample mass (Test series: 12202, 12261).

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Telephone: 630.851.7330 • Fax: 630.851.9309

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 2528 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

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[1] Cleary, Thomas. *Residential Smoke Alarm Performance*. Building and Fire Research Laboratory, National Institute of Standards and Technology. UL Smoke and Fire Dynamics Seminar. November, 2007.

[2] Mueller, B.A. *Randomized controlled trial of ionization and photoelectric smoke alarm functionality*. Injury Prevention BMJ. 2008; 14:80-86.

[3] 1997 Fire Awareness/Escape Planning Study for National Fire Protection Association, Quincy, MA, August 1997, Tables 3 & 4.

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photoelectric product line. For your reference, our Battery Operated Photoelectric Products include:

- **Photoelectric Smoke Alarms**
- **Photoelectric Smoke Alarms with Escape Light**
- **Photoelectric Smoke Alarms with Long Life Lithium Battery**
- **Combination Photoelectric Smoke and Carbon Monoxide Alarm**
- **Combination Photoelectric Smoke and Carbon Monoxide Alarm with Voice Output Including Hazard Location**
- **ONELINK® Photoelectric Wireless Interconnected with Voice Output Smoke Alarms**
- **ONELINK® Photoelectric Wireless Interconnected Smoke and Carbon Monoxide Alarms with Voice Output Including Hazard Location**

In addition, our Hardwired Photoelectric Product Line will support all new construction and replacement needs:

- **Photoelectric Smoke Alarms with Interconnect Capability**
- **Photoelectric Smoke Alarms with Battery Backup with Interconnect Capability**
- **Photoelectric Smoke Alarms with Escape Light and Battery Backup with Interconnect Capability**
- **Photoelectric Smoke Alarms with Voice Output Including Hazard Location and Interconnect Capability**

Few entities exist that dedicate more time and resources towards safety-related public policy and education as effectively as the fire service. Please use this information in your safety education efforts. You are encouraged to contact our External Communications department with any questions or concerns. Let us be a resource for your efforts in public safety education. For more information please contact Tom Russo of Public Relations at (630) 499-3214.

RISK ANALYSIS OF RESIDENTIAL FIRE DETECTOR PERFORMANCE

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

Based on data from the National Fire Detector Project and research titled: Full Scale Research and Testing of Fire Detection Systems in a Residential Structure conducted at Texas A&M University

August 1995

RISK ANALYSIS OF RESIDENTIAL FIRE DETECTOR PERFORMANCE

ABSTRACT

As the percentage of American homes with smoke detectors increased to an estimated 92 percent in 1994, the fire related death rate in one and two family dwellings likewise experienced an increase. To determine the probability of a fatality based on the performance of residential fire detectors, data from various studies were utilized and integrated into a risk analysis. To effectively accomplish this objective, a fault tree model was generated which provided the basis for the development of the risk analysis. Data generated by the National Smoke Detector Project and from real scale experiments conducted by researchers at Texas A&M University was consolidated and utilized in the development of a realistic risk analysis for the performance of fire detectors for various fire scenarios. A review of the risk analysis provides a clear example of the probability of a fatality if there is no consideration as to the risk involved with the use of the various types of fire detectors. Certain types of fire detectors are more reliable for the different types of fires. Therefore, recommendations as to the type and location of the fire detector should include the type of fire ignition that would most likely occur and the most reliable detector that can be installed in that location.

RISK ANALYSIS OF FIRE DETECTOR PERFORMANCE

Background

It has been reported that during a twenty year period, at least ten independent studies on fire detector performance were conducted producing 206 real-scale experiments in single family houses or apartment buildings utilizing actual household items such as upholstered furniture mattresses, wiring and trash baskets as the fire source. As noted, all tests used standard heat and smoke detectors,assumed to be new and available for purchase at the time the test were conducted. Interestingly, the studies presented conclusions that were essentially identical [1]. Typically, the studies offered a review of the performance profile for the various fire detectors to several different fire scenarios. Conclusions from several of the studies were utilized in the development of the current requirements for residential fire detectors.

The fire related death rate in residential structures, demonstrated a corresponding decline with the increase in the percentage of households with smoke detectors [2]. Annual fire related deaths began this decline from 12,000 deaths in 1975 to approximately 5,000 deaths in 1990, while residential smoke detector coverage increased by 60 percent [3]. The civilian fire related deaths in one and two family dwellings reversed the 1980's downward trend in 1992 with an increase of 8.8 percent above the previous year [4]. This upward trend in fire related deaths continued for the next several years, even as the reported percentage of one and two-family dwellings with a smoke detector increased to a high of 88 percent in 1992 [5] and an estimated 92 percent coverage rate in 1994. This trend has precipitated a number of organizations with an interest in fire safety to develop a review process of the apparent problems being experienced in an effort to determine the cause and a possible solution. An example of this effort was the creation of the National Smoke Detector Project, which was a joint project between the Consumer Product Safety Commission (CPSC), the Congressional Fire Services Institute, the U.S. Fire Administration (USFA) and the National Fire Protection Association (NFPA). This effort resulted in a national survey to determine the numbers and types of smoke detectors installed in households and the proportion of installed detectors that are in working order [5]. Another major study generated by the National Smoke Detector Project was the "Fire Incident Study", developed to identify the reasons why smoke detectors failed to alarm in residential fires [6]. The data collected from both of the previously mentioned studies, while important, was limited in scope since the "Smoke Detector Operability Survey" only utilized non-destructive simulated smoke test to determine if the smoke detector was operable [5]. The "Fire Incident Study" investigated smoke detectors where it was believed the detectors did not alarm when it should have [6]. In order to expand the scope of the study on fire detector inoperability, data from the previous studies were integrated with real-scale experiments conducted by a team of researchers at Texas A&M University with assistance provided by researchers from Iowa State University and Colorado State University. The outcome of this consolidation of data resulted in the development of a realistic risk analysis for the performance of fire detectors for various fire scenarios.

The process of utilizing data from the various studies, integrated into one risk analysis, provides an evaluation tool to determine the probability of success or failure of a fire detector to alarm with normal installation and maintenance in a residential structure. This process permits the incorporation of actual influences such as lack of cleaning, power disconnected because of nuisance alarm and contact corrosion to be considered with the demonstrated real-scale performance of the fire detectors in controlled experiments. To effectively accomplish this objective, a fault tree model was generated which provided the bases for the development of the risk analysis.

Elements Utilized in Development of Risk Analysis

Smoke Detector Operability Survey As previously noted, The National Smoke Detector Project generated the "Smoke Detector Operability Survey" to determine the numbers and types of smoke detectors installed in households, the proportion of installed smoke detectors that are working, the ways in which smoke detectors are failing, factors that are leading to non-working detectors and types of households or housing that are more likely to have non-working smoke detectors [5]. As a part of this survey, data were collected for evaluating smoke detectors by including such factors as the types of smoke detectors, the degree of maintenance and the operability of the detector when submitted to the activation of the test button and the application of simulated smoke.

Fire Incident Study The National Smoke Detector Project also provided for another study and report called the "Fire Incident Study". This study was based on data collected by fire departments from 15 U.S. cities. The study stated that its investigations of detector operability was based on residential fires where it was believed that the detector did not alarm [6]. The nature of this study limited the data collected, yet, it does provide important information on the operability of smoke detectors when exposed to real-scale fires. When factored in with data from the other studies, this study becomes a necessary element in the process to determine why there is a continuing increase in the residential fire related death rate.

Full Scale Testing of Fire Detection Systems The previous two studies did not address the performance characteristics of smoke detectors when exposed to different real-scale fire scenarios during controlled experiments. For this data, full scale research and testing of fire detection systems were conducted in a residential structure by a team of researchers at Texas A&M University. The tests for this research were conducted during a two and one-half year period beginning in 1991. The residential structure utilized was an existing wood frame, two bedroom, living room, kitchen, bath and utility room building constructed in 1945 near Taylor, Texas. The interior walls and ceiling of the wood framed structure were covered with one-half inch (1.27 cm) gypsum board with hardwood flooring.

Since various and multiple full scale fire tests were designed to be conducted in the residential structure, a number of modifications were incorporated into the structure to enhance the fire resistance of the areas to be exposed to fire. The modifications were designed to negate the destructive actions of multiple full scale fires limited to the room of fire origin . The modifications were also designed to upgrade the interior conditions to replicate environmental conditions such as a heating/ventilation/air conditioning system (HVAC) and ceiling fans, similar to those found in current residential structures.

Prefabricated fire detector mounting panels were designed for the installation of a new ionization smoke detector, a new photoelectric smoke detector, a new fusible link detector, 117°F (47.22°C), and a new fusible link residential sprinkler head, 135°F (57.22°C). Each of the fire detectors were wired to permit continuous monitoring of the detector. The nine volt power supply smoke detectors were wired to create a monitor circuit across the alarm contact points. Alarm activation would cause a voltage flow in the monitor circuit that would be recorded by a computer. Shielded monitor circuits were connected to a mechanical switch on each fusible link detector and across the release spring of each sprinkler head. A remote low voltage power supply served each of these circuits and fuse operation. The point of detector activation caused a resistance change in the monitor circuits, which in turn was recorded on a computer. The prefabricated fire detector mounting panels were installed in the room of fire origin and in the means of egress.

Room of fire origin and means of egress environmental monitoring for tenable conditions included smoke obscuration measurements and thermocouples at the point of fire detector installation, at thirty inches (76.2cm) and five feet (1.5m) above the finished floor. Also, to assist in determining tenability of the room of fire origin and the means of egress at the point of detector activation, probes, utilized to acquire samples from the two rooms under study, penetrated the wall and extended two feet (.61m) into the test area. The intake end of the probe was protected from direct exposure to the heat without restricting the movement of the air sample. The air sample was retrieved from the two spaces to be monitored with a sampling pump connected to equipment capable of providing an analysis of the oxygen, hydrogen sulfide, carbon monoxide, hydrocarbon and carbon dioxide levels.

The room of fire origin was designed to simulate a typical residential arrangement with fabric and finishes selection based on data from the Fire Incident Reporting System [7]. In order to maintain a constant fire load for each of the fire test, the fabric and furnishings were identical for all test.

The fire test scenarios were designed to replicate smoldering ignition and flame ignition fires. Each of the smoldering ignition fire test occurred in an upholstered easy chair where the back cushion meets the seat cushion. The flame ignition fire test originated in a wicker waste basket filled with a weighted amount of news print. There were a total of sixteen different fire test scenarios with the variables being the door between the room of origin and the means of egress in an open/closed position, the HVAC system on/off and a ceiling fan located in the room of origin on/off. Each of the various fire scenarios were replicated three times with data from the three test averaged and the result utilized as the data point for evaluation. The time required for each detector to activate while the room of fire origin was within a tenable limit was recorded, but not utilized as a means of comparison in this study. The only criteria concerning the activation time of the fire detectors used in this study required an activation while the room of fire origin was tenable.

Development of an Evaluation Model

Fault tree analysis has become one of the principal methods of systems safety analysis. A fault tree is a model that can both graphically and logically be used as a diagnostic tool. Properly developed, the fault tree is a detailed deductive analysis that can be used to illustrate and predict the most likely cause of system failure. Initially, the fault tree analysis was developed by Bell Laboratories for the U.S. Air Force for the purpose of determining the possibilities and probabilities of an inadvertent launch of a minuteman missile and of an inadvertent arming of a nuclear device [8].

A fault tree model graphically and logically represents the various combinations of possible fault events and normal events that might occur in a system. It is a logic diagram that depicts certain events that must occur in order for other events to occur. The events are called failures if they are basic initiating events and faults if they are initiated by other events. The occurrence of these events will lead to the occurrence of the top event. The different events utilized in the fault tree model are represented by standard event symbols.

The events are connected by fundamental logic gates referred to as the OR and the AND gates. Each gate has an output based on multiple inputs. The gate inputs are the more basic or lower events which relate to the gate output as a higher event. The OR gate describes a situation where the output event will exist if one or more of the input events exist. The AND gate describes the logical operation that requires the coexistence of all input events to produce the output event [9]. The fault tree is composed by using the deductive process by going from the highest or top event to the more basic events, or from output to inputs. The two gates relate the different events by using the Boolean Algebraic operations.

The construction methodology of the fault tree model represents an order of sequences of events that lead to the undesired top event. The sequence of fault events is sequentially related to the undesired top event by OR and AND gates. The input event to each logic gate is also the output of other logic gates at a lower level. These events are developed downward until the sequences of events lead to basic causes called basic events.

The thought process involved in constructing the fault tree follows established rules that determine the type of gate to use and inputs to the gate. The structuring process is used to develop fault flows in a fault tree when a system is examined on a functional basis such as consideration of system element failure. The structuring process identifies three failure mechanisms or causes that can contribute to a component being in a fault state.

1. A primary failure is a failure due to the internal characteristics of the system element under consideration.
2. A secondary failure due to excessive environmental or operational stress placed on the system element.
3. A command fault is an inadvertent operation or non operation of a system element due to failure of initiating element to respond as intended to system conditions [10].

Any fault event that can be described in terms of mechanism failure is defined as a state-of-component fault. Events that have a more basic cause that cannot be described in terms of a simple component failure are termed state-of-system fault events.

The evaluation of the fault tree may be qualitative or quantitative, depending on the scope of the analysis. Although it was developed to determine quantitative probabilities, it is more commonly used for its qualitative aspects. The reason for this stems from the sequence of preparing a qualitative analysis first in order to make a quantitative analysis. Often, the objective of fault tree evaluation can be satisfied by preparing the qualitative analysis [8]. If the system design is found inadequate, then the design can be upgraded and the fault tree re-evaluated.

The system of interest in this study is the performance characteristics of various types of fire detectors exposed to two different fire scenarios. One scenario utilized a smoldering fire source and the other scenario utilized a flame fire source. In this study, the undesired top event was stated in terms of a fatality due to no alarm of any or all of the fire detectors, creating an untenable environment from toxic fire gases or smoke. Injuries are difficult to define, therefore, they were not incorporated into this study. The top event was analyzed utilizing statistical information that either exist or can be developed analytically.

Determination of Minimum Cut Sets

One of the major objectives of a fault tree model is to determine when the occurrence of basic events can cause the occurrence of the top event. This determination can be derived by developing what are called the minimum cut sets. A cut set is a set of basic events whose occurrence will cause the top event to occur. A cut set is minimal if it cannot be replaced and still insure the occurrence of the top event. After the minimal cut sets for a fault tree have been determined, a non redundant fault tree can be developed. A non redundant fault tree consists of basic events that have been eliminated by using certain identities from set theory [9]. The minimal cut sets for system analysis are shown on Figure 6 for smoldering ignition fire and Figure 7 for flame ignition fire.

Probability Assignments for Basic Events

The twenty-four basic events (X_1 - X_{24}) for each fire scenario, developed from the fault tree will be used for the model with probabilities for each, given in Figure 4 and 5. Basic event X_1 will be 1.0 for both fire scenarios since the smoldering or flame fire is ignited in order to conduct the test. Basic events X_2 - X_6 were developed from information generated in the Smoke Detector Operability Survey Report on Findings, November 1993, prepared for the National Smoke Detector Project and adjusted to reflect the performance of the ionization detector [5] . Basic events X_7 - X_{10} represents data collected on the performance of ionization detectors in either a smoldering or flame ignition scenario from the research project titled, Full Scale Research and Testing of Fire Detection Systems in a Residential Structure, conducted at Texas A&M University [11]. Basic events X_{11} - X_{15} were developed from information generated in the Smoke Detector Operability Survey Report on Findings, November 1993, and adjusted to reflect the performance of the photoelectric detector [5]. Basic events X_{16} - X_{19} represents data collected on the performance of the photoelectric detectors in either a smoldering or flame ignition scenario from research conducted at Texas A&M University [11]. Basic events X_{20} - X_{24} represents data collected on the performance of the fusible link fire detector in either a smoldering or flame ignition scenario from research conducted at Texas A&M University [11].

CONDITION OF SMOKE DETECTORS OBSERVED

Conditions Observed	Probability of Occurrence	
	Ionization	Photoelectric
Lack of Cleaning	.029	.008
Power Disconnected Because of Nuisance Alarm	.095	.019
Loose Wires	.0397	.0043
Contract Corrosion	.007	.002
Broken, Not Working-Disconnected Contact Poor	.044	.008

Data source [5]

Figure 1

PERFORMANCE PROFILE OF RESIDENTIAL FIRE DETECTORS BASED ON FULL SCALE SMOLDERING FIRE TEST

Type of Detector	Door Between Room of Origin & Means of Egress Open/Closed	Failure of Activation While Room of Origin is within Tenable Limit, Probability of Occurrence	Failure of Activation While Means of Egress is within Tenable Limit, Probability of Occurrence
Ionization	Open	.67	$1x10^{-6}$
Ionization	Closed	$1x10^{-6}$	.67
Photoelectric	Open	$1x10^{-6}$	$1x10^{-6}$
Photoelectric	Closed	$1x10^{-6}$	$1x10^{-6}$
Fusible Link	Open	.999	.999
Fusible Link	Closed	.999	.999

Data source [10]

Figure 2

PERFORMANCE PROFILE OF RESIDENTIAL FIRE DETECTORS BASED ON FULL SCALE FLAME IGNITION FIRE TEST

Type of Detector	Door Between Room of Origin & Means of Egress Open/Closed	Failure of Activation While Room of Origin is within Tenable Limit, Probability of Occurrence	Failure of Activation While Means of Egress is within Tenable Limit, Probability of Occurrence
Ionization	Open	$1x10^{-6}$	$1x10^{-6}$
Ionization	Closed	$1x10^{-6}$	.67
Photoelectric	Open	$1x10^{-6}$	$1x10^{-6}$
Photoelectric	Closed	$1x10^{-6}$	.50
Fusible Link	Open	$1x10^{-6}$	.167
Fusible Link	Closed	$1x10^{-6}$	.50

Data source [10]

Figure 3

DEFINITION OF BASIC EVENT VARIABLES
SMOLDERING IGNITION

Basic Event	Description of Event	Probability Occurrence
X_1	Smoldering Ignition	1.00
X_2	Lack of Cleaning (Ionization Detector)	.029
X_3	Power Disconnected Because of Nuisance Alarm (Ionization Detector)	.095
X_4	Loose Wires (Ionization Detector)	.0397
X_5	Contact Corrosion (Ionization Detector)	.007
X_6	Broken, Not Working-Disconnected, Contact Poor (Ionization Detector)	.044
X_7	Fails, Door Open (Ionization Detector in Room of Fire Origin)	.67
X_8	Fails, Door Closed (Ionization Detector in Room of Fire Origin)	$1x10^{-6}$
X_9	Fails, Door Open (Ionization Detector Outside of Room of Fire Origin)	$1x10^{-6}$
X_{10}	Fails, Door Closed (Ionization Detector Outside of Room of Fire Origin)	.67
X_{11}	Lack of Cleaning (Photoelectric Detector)	.008
X_{12}	Power Disconnected Because of Nuisance Alarm (Photoelectric Detector)	.019
X_{13}	Loose Wires (Photoelectric Detector)	.0043
X_{14}	Contact Corrosion (Photoelectric Detector)	.002
X_{15}	Broken, Not Working-Disconnected, Contact Poor (Photoelectric Detector)	.008
X_{16}	Fails, Door Open (Photoelectric Detector in Room of Fire Origin)	$1x10^{-6}$
X_{17}	Fails, Door Closed (Photoelectric Detector in Room of Fire Origin)	$1x10^{-6}$
X_{18}	Fails, Door Open (Photoelectric Detector Outside of Room of Fire Origin)	$1x10^{-6}$
X_{19}	Fails, Door Closed (Photoelectric Detector Outside of Room of Fire Origin)	$1x10^{-6}$
X_{20}	Mechanical Failure (Fusible Link Detector)	$1x10^{-6}$
X_{21}	Fails, Door Open (Fusible Link Detector in Room of Fire Origin)	.999
X_{22}	Fails, Door Closed (Fusible Link Detector in Room of Fire Origin)	.999
X_{23}	Fails, Door Open (Fusible Link Detector Outside of Room of Fire Origin)	.999
X_{24}	Fails, Door Closed (Fusible Link Detector Outside of Room of Fire Origin)	.999

Figure 4

DEFINITION OF BASIC EVENT VARIABLES
FLAME IGNITION

Basic Event	Description of Event	Probability Occurrence
X_1	Flame Ignition	1.00
X_2	Lack of Cleaning (Ionization Detector)	.029
X_3	Power Disconnected Because of Nuisance Alarm (Ionization Detector)	.095
X_4	Loose Wires (Ionization Detector)	.0397
X_5	Contact Corrosion (Ionization Detector)	.007
X_6	Broken, Not Working-Disconnected, Contact Poor (Ionization Detector)	.044
X_7	Fails, Door Open (Ionization Detector in Room of Fire Origin)	$1x10^{-6}$
X_8	Fails, Door Closed (Ionization Detector in Room of Fire Origin)	$1x10^{-6}$
X_9	Fails, Door Open (Ionization Detector Outside of Room of Fire Origin)	$1x10^{-6}$
X_{10}	Fails, Door Closed (Ionization Detector Outside of Room of Fire Origin)	.67
X_{11}	Lack of Cleaning (Photoelectric Detector)	.008
X_{12}	Power Disconnected Because of Nuisance Alarm (Photoelectric Detector)	.019
X_{13}	Loose Wires (Photoelectric Detector)	.0043
X_{14}	Contact Corrosion (Photoelectric Detector)	.002
X_{15}	Broken, Not Working-Disconnected, Contact Poor (Photoelectric Detector)	.008
X_{16}	Fails, Door Open (Photoelectric Detector in Room of Fire Origin)	$1x10^{-6}$
X_{17}	Fails, Door Closed (Photoelectric Detector in Room of Fire Origin)	$1x10^{-6}$
X_{18}	Fails, Door Open (Photoelectric Detector Outside of Room of Fire Origin)	$1x10^{-6}$
X_{19}	Fails, Door Closed (Photoelectric Detector Outside of Room of Fire Origin)	.50
X_{20}	Mechanical Failure (Fusible Link Detector)	$1x10^{-6}$
X_{21}	Fails, Door Open (Fusible Link Detector in Room of Fire Origin)	$1x10^{-6}$
X_{22}	Fails, Door Closed (Fusible Link Detector in Room of Fire Origin)	$1x10^{-6}$
X_{23}	Fails, Door Open (Fusible Link Detector Outside of Room of Fire Origin)	.167
X_{24}	Fails, Door Closed (Fusible Link Detector Outside of Room of Fire Origin)	.50

Figure 5

Fault Tree Development to Determine Probability of Fire Detector Failure for "Smoldering" Ignition

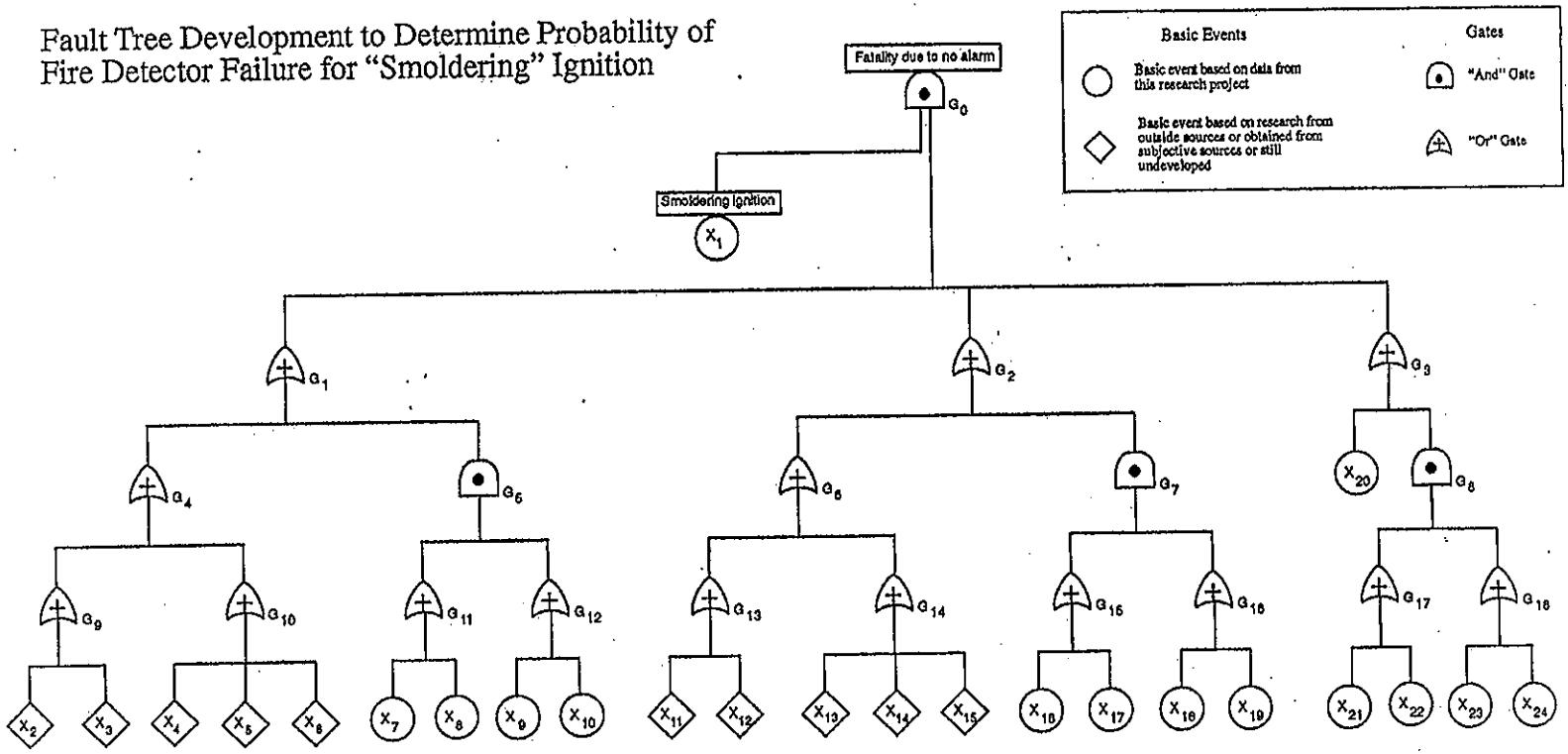

Figure 6

Fault Tree Development to Determine Probability of Fire Detector Failure for "Flame" Ignition

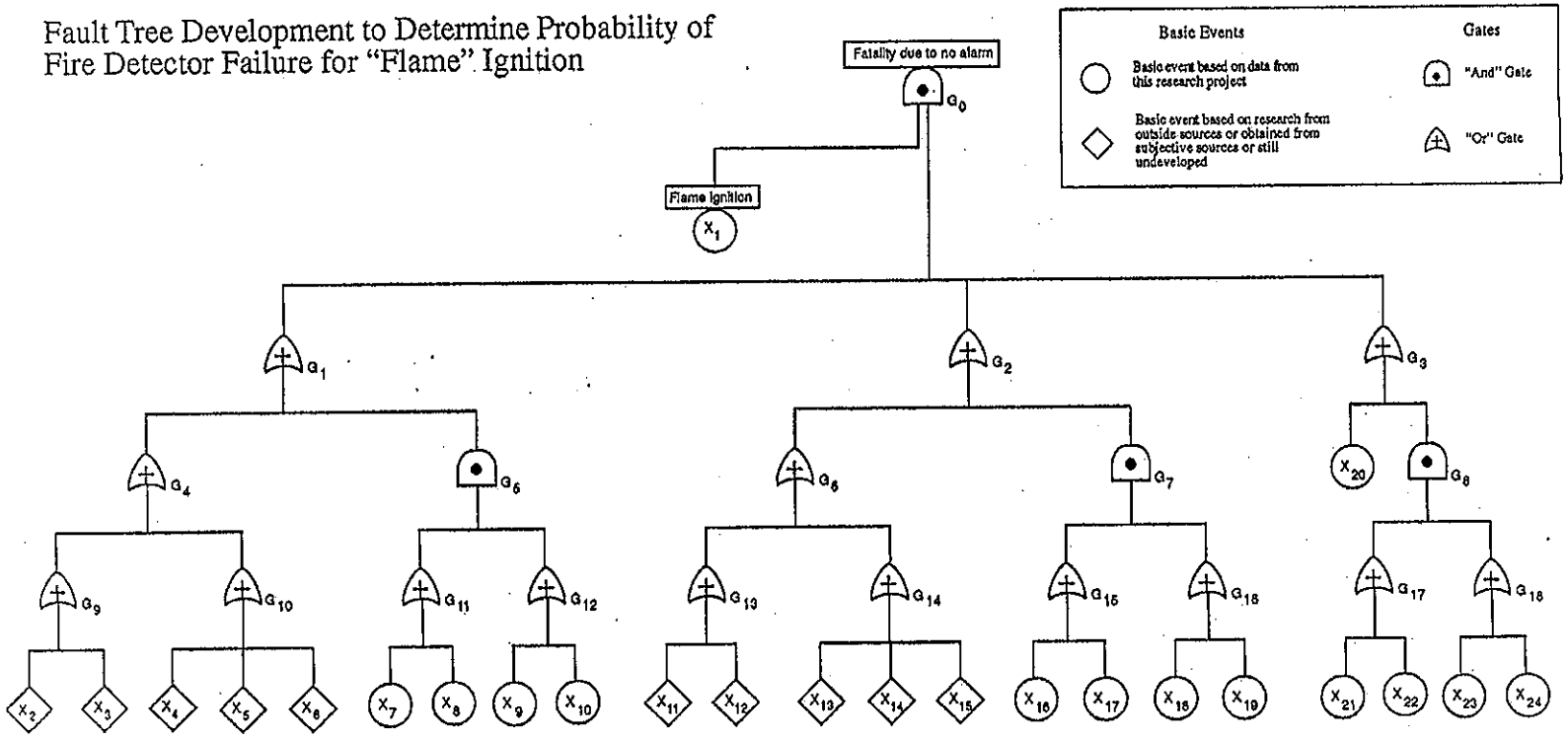

Figure 7

Fault Tree Model With Fatality as Top Event Due to No Alarm

Utilizing fault tree theory with a non-redundant fault tree, the probability of the top event failure will equal the probability of failure for one or more of the minimal cut sets. In this study, the top event failure is expressed as a fatality due to no alarm while the room of fire origin is within tenable limits. The probability of occurrence of the top event may be obtained by using Boolean Algebra calculus for the different "OR" and "AND" gates.

In general, if the event inputs to an "AND" gate are A_1, A_2, A_3.....A_n, then the output A_o, in set theoretic terms, is given by:

$$A_o = A_1 \cap A_2 \cap \ldots\ldots \cap A_n,$$

in which the symbol $\cap$ represents the intersection of the events.

For an "OR" gate with input events B_1, B_2, B_3.....B_n, the output B_o is given by:

$$B_o = B_1 \cup B_2 \cup \ldots\ldots \cup B_n,$$

in which the symbol $\cup$ represents the union of the events.

In order to obtain the top event probability, the output event of each "AND" and "OR" gate need to be determined by applying the general probability rules to the set theoretic formulas mentioned heretofore.

For two input events to an "AND" gate, the formula becomes:

$$P[A_1 \cap A\ ] = P[A_1] \times P[A_2 \mid A_1]$$

in which $P[A_2 \mid A_1]$ stands for the probability of A_2 given the probability of A_1 where $\mid$ means, "given the". If independence exist for the variables of the input events, then:

$$P[A_1 \cap A_2] = P[A_1] \times P[A_2].$$

For multiple variables, this becomes:

$$P[A_1 \cap A_2 \cap \ldots\ldots \cap A_n] = P[A_1] \times P[A_2] \times \ldots\ldots \times P[A_n].$$

which is the multiplication rule.

Independence here is assumed for these input variables meaning that the probability of A_1, $P[A_1]$, is not affected by the probability of A_2, $P[A_2]$, and vice versa. This independence is assumed to be valid for all event input variables in the actual fault tree model when these variables enter an "And" gate.

For two input event variables to an "OR" gate, the formula $P[B_1 \cup B_2]$ becomes:

$$P[B_1 \cup B_2] = P[B_1] + P[B_2] - P[B_1] \times P[B_2]$$

for non-mutual exclusive events. In case two input event variables are mutual exclusive, then the formula is:

$$P[B_1 \cup B_2] = P[B_1] + P[B_2]$$

Five input event variables are used in the actual fault tree model. The general formula for five non-mutual exclusive event input variables to an "OR" gate then becomes:

$$\begin{aligned}
&[P(B_1) \cup P(B) \cup P(B_3) \cup P(B_4) \cup P(B_5)] = \\
&[P(B_1) + P(B_2) + P(B_3) + P(B_4) + P(B_5)] - \\
&P(B_1) \times [P(B_2) + P(B_3) + P(B_4) + P(B_5)] - \\
&P(B_2) \times [P(B_3) + P(B_4) + P(B_5)] - \\
&P(B_3) \times [P(B_4) + P(B_5)] - [P(B_4) \times P(B_5)] + \\
&[P(B_1) \times P(B_2) \times P(B_3) \times P(B_4) \times P(B_5)]
\end{aligned}$$

Probability of the Top Event Occurring During a Smoldering Ignition Fire

The formula to calculate the probability of the top event (E), based on the performance of the ionization detector is:

$$\begin{aligned}
P(E) = \quad & [\, P(X_2) + P(X_3) + P(X_4) + P(X_5) + P(X_6) \,] - \\
& [\, P(X_2) \times P(X_3) \,] - [\, P(X_2) \times P(X_4) \,] - [\, P(X_2) \times P(X_5) \,] - \\
& [\, P(X_2) \times P(X_6) \,] - [\, P(X_3) \times P(X_4) \,] - [\, P(X_3) \times P(X_5) \,] - \\
& [\, P(X_3) \times P(X_6) \,] - [\, P(X_4) \times P(X_5) \,] - [\, P(X_4) \times P(X_6) \,] - \\
& [P(X_5) \times P(X_6)] + [\, P(X_2) \times P(X_3) \times P(X_4) \times P(X_5) \times \\
& [P(X_6) \,] + [\, P(X_7) + P(X_8) \,] \times [\, P(X_9) + P(X_{10}) \,]
\end{aligned}$$

X_7 and X_8 as well as X_9 and X_{10} are mutual exclusive events.

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 4, the probability of the top event (E) occurring based on the performance of the ionization detector during a smoldering ignition is:

P(E) = 55.8% (Ionization detector only)

The formula to calculate the probability of the top event (E), based on the performance of the photoelectric detector is:

$$P(E) = [\ P(X_{11}) + P(X_{12}) + P(X_{13}) + P(X_{14}) + P(X_{15})\ ] - [\ P(X_{11}) \times P(X_{12})\ ] - [\ P(X_{11}) \times P(X_{13})\ ] - [\ P(X_{11}) \times P(X_{14})\ ] - [\ P(X_{11}) \times P(X_{15})\ ] - [\ P(X_{12}) \times P(X_{13})\ ] - [\ P(X_{12}) \times P(X_{14})\ ] - [\ P(X_{12}) \times P(X_{15})\ ] - [\ P(X_{13}) \times P(X_{14})\ ] - [\ P(X_{13}) \times P(X_{15})\ ] - [\ P(X_{14}) \times P(X_{15})\ ] + [\ P(X_{11}) \times P(X_{12}) \times P(X_{13}) \times P(X_{14}) \times P(X_{15})\ ] + [\ P(X_{16}) + P(X_{17})\ ] \times [\ P(X_{18}) + P(X_{19})\ ]$$

X_{16} and X_{17} as well as X_{18} and X_{19} are mutual exclusive events.

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 4, the probability of the top event (E) occurring based on the performance of the photoelectric detector during a smoldering ignition is:

P(E) = 4.06% (Photoelectric detector only)

The formula to calculate the probability of the top event (E), based on the performance of the fusible link detector is:

$$P(E) = P(X_{20}) + [\ P(X_{21}) + P(X_{22})\ ] \times [\ P(X_{23}) + P(X_{24})\ ]$$

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 4, the probability of the top event (E) occurring based on the performance of the fusible link detector during a smoldering ignition is:

P(E) = 99.9% (Fusible link detector only)

Probability of the Top Event Occurring During a Flame Ignition Fire

The formula to calculate the probability of the top event (E), based on the performance of the ionization detector is:

$$P(E) = [\ P(X_2) + P(X_3) + P(X_4) + P(X_5) + P(X_6)\ ] - [\ P(X_2) \times P(X_3)\ ] - [\ P(X_2) \times P(X_4)\ ] - [\ P(X_2) \times P(X_5)\ ] - [\ P(X_2) \times P(X_6)\ ] - [\ P(X_3) \times P(X_4)\ ] - [\ P(X_3) \times P(X_5)\ ] - [\ P(X_3) \times P(X_6)\ ] - [\ P(X_4) \times P(X_5)\ ] - [\ P(X_4) \times P(X_6)\ ] - [\ P(X_5) \times P(X_6)\ ] + [\ P(X_2) \times P(X_3) \times P(X_4) \times P(X_5) \times P(X_6)\ ] + [\ P(X_7) + P(X_8)\ ] \times [\ P(X_9) + P(X_{10})\ ]$$

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 5, the probability of the top event (E) occurring based on the performance of the ionization detector during a flame ignition is:

(P)E = 19.8% (Ionization detector only)

The formula to calculate the probability of the top event (E), based on the performance of the photoelectric detector is:

$$P(E) = [P(X_{11}) + P(X_{12}) + P(X_{13}) + P(X_{14}) + P(X_{15})] - [P(X_{11}) \times P(X_{12})] - [P(X_{11}) \times P(X_{13})] - [P(X_{11}) \times P(X_{14})] - [P(X_{11}) \times P(X_{15})] - [P(X_{12}) \times P(X_{13})] - [P(X_{12}) \times P(X_{14})] - [P(X_{12}) \times P(X_{15})] - [P(X_{13}) \times P(X_{14})] - [P(X_{13}) \times P(X_{15})] - [P(X_{14}) \times P(X_{15})] + [P(X_{11}) \times P(X_{12}) \times P(X_{13}) \times P(X_{14}) \times P(X_{15})] + [P(X_{16}) + P(X_{17})] \times [P(X_{18}) + P(X_{19})]$$

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 5, the probability of the top event (E) occurring based on the performance of the photoelectric detector during a flame ignition is:

(P)E = 3.99% (Photoelectric smoke detector only)

The formula to calculate the probability of the top event (E), based on the performance of the fusible link detector is:

$$P(E) = P(X_{20}) + [P(X_{21}) + P(X_{22})] \times [P(X_{23}) + P(X_{24})]$$

Using the above equation and the values of the variables provided from the summary of probability of basic events in Figure 5, the probability of the top event (E) occurring based on the performance of the fusible link detector during a flame ignition is:

$P(E) = 1 \times 10^{-6}\%$ (Fusible link detector only)

The forgoing may be summarized as follows:

RISK ANALYSIS FOR THE PERFORMANCE OF FIRE DETECTORS PROBABILITY OF THE OCCURRENCE OF FAILURE FOR THE TOP EVENT

Type of Detector	Smoldering Ignition Scenario	Flame Ignition Scenario
Ionization	55.8%	19.8%
Photoelectric	4.06%	3.99%
Fusible Link	99.9%	$1 \times 10^{-6}\%$

Figure 8

Risk Analysis of Fire Detector Performance

Based on the data collected for the National Smoke Detector Project and research conducted at Texas A&M University, a risk analysis of the various types of fire detectors was generated for two types of fire scenarios, smoldering ignition and flame ignition. This risk analysis included basic event considerations such as the known performance of fire detectors under normal use conditions; the door between the room of fire origin and hallway in an open or closed position; and the location of the detector either in the room of origin or in the means of egress. The results of the risk analysis offers the probability of occurrence for failure of the fire detector to provide a warning while the room of origin is still tenable, leading to the top event which is defined as a fatality.

Smoldering Ignition As can be observed from Figure 8, during the smoldering ignition fire, the photoelectric detector offered the most reliable method of detecting the fire while the room of origin was still in a tenable condition. The probability of a fatality due to the failure of the photoelectric detector to detect a smoldering ignition fire is 4.06%. The probability of a fatality due to the failure of an ionization detector to detect a smoldering ignition fire is 55.8%. This high probability of a fatality due to the failure of the ionization detector can be contributed to a number of factors such as performance under normal use conditions and an inability to consistently detect smoldering smoke particles. The probability of a fatality due to the failure of the fusible link detector to detect a smoldering ignition fire is 99.9%. This higher probability of a fatality is due to the fact that the smoldering fire ignition normally produces a room of origin temperature differential of ten (10^{o} F) degrees Fahrenheit (2.8^{o} C) +/-, therefore the required heat to fuse the fusible link detector is not present.

Flame Ignition As can be observed from Figure 8, during the flame ignition fire, the fusible link detector offered the most reliable method of detecting the fire while the room of origin was still in a tenable condition. The probability of a fatality due to the failure of the fusible link detector to detect a flame ignition fire is 1×10^{-6}%. The probability of a fatality due to the failure of the photoelectric detector to detect a flame ignition fire is 3.99%. The probability of a fatality due to the failure of the ionization detector to detect a flame ignition fire is 19.8%. While the ionization detector responds effectively to a flame ignition, a number of factors such as performance under normal use conditions tends to increase the probability of failure

Interpretation

The development of the risk analysis offers a partial insight into why there has been an increase in the residential fire related death rate for the last several years in spite of an increase in the residences reported to have smoke detectors installed. The current thought process demonstrated by officials in the position to make recommendations, has been to just install a smoke detector in the home without consideration as to the type of potential fire ignition. A review of the risk analysis provides a clear example of the probability of a fatality if there is no consideration as to the risk involved with the use of the various types of fire detectors. As illustrated, the various types of fire detectors provide different levels of risk which supports the need for a change in the current thought process. Certain types of fire detectors are more reliable for the different types of fires, therefore, recommendations as to the type and location of the fire detector should include the type of fire ignition that would most likely occur and the most reliable detector that can be installed in that location. Only when the risk involved with the use of a certain type of fire detector is considered in any recommendation, can there be an improvement in the residential fire related death rate.

[1] Bukowski, Richard; "Studies Assess Performance of Residential Detectors"; *NFPA Journal;* January/February 1993; p. 48 - 54

[2] Le Coque, Paul G. and Harris, King; "State by State...An Update of Residential Smoke Detector Legislation"; *Fire Journal;* January/February 1990; p. 41 - 47

[3] Baribault, Marlene and Solomon, Lewis; "The Smoke Detector Industry"; Wellesley, MA: Venture Development Corporation

[4] Karter, Michael J.; "Fire Loss in the United States in 1992"; *NFPA Journal;* September/October 1993; p. 78 - 87

[5] Smith, Charles L.; "Smoke Detector Operability Survey Report on Findings"; Consumer Product Safety Commission; November 1993

[6] Smith, Linda E.; "Fire Incident Study: National Smoke Detector Project"; Consumer Product Safety Commission; March 1994

[7] "Fire Incident Reporting System"; Texas Commission on Fire Protection Personnel and Education; 1990

[8] Barlow, R., Russell, J. and Singpurwalla, N; "Reliability and Fault Tree Analysis"; Society for Industrial and Applied Mathematics, 1975

[9] Stubbs, N. and Sikorsky, C.; "Occupant Safety in Vertical Hurricane Shelters"; Technical Report 4968 S-3, National Science Foundation 1985

[10] Haasl, D.; "Advanced Concepts in Fault Tree Analysis"; Product System Safety Symposium; Seattle, Washington; 1985

[11] Grosse, Larry; "Full Scale Research and Testing of Fire Detection Systems in a Residential Structure"; Technical Report for the Research Foundation, Texas A&M University; 1995

New York City Council
Committee on Housing and Building

October 24, 2013
Presentation by Dean Dennis

Thank you for providing this opportunity to lend support for the important legislation before you. I have provided numerous presentations and seminars on the topic of smoke alarm technology. To name a few, I have been to California three times and testified before the State Fire Marshal's Office, and was instrumental in helping Albany, CA to become the first city in California to go photoelectric. In Ohio, I have aided 8 municipalities to require photoelectric alarms including the city of Cincinnati. In Miami, FL, I presented before participants from 25 different countries at the International Conference for Innovation in Higher Education.

I cannot impress upon you how important it is to require photoelectric alarms in the city of New York. Most New Yorkers have only ionization alarms yet they have serious flaws. I want to share some information from some legal cases below:

Mercer vs BRK (1998)

In January 1993 Bradley Mercer was killed and his brother Travis was badly burnt n a house fire in Davenport Iowa. Their new **ionization smoke alarm** failed to sound a timely warning in the smoldering stage of the fire. The Mercer's sued BRK, the world's largest smoke alarm manufacturer.

In his summation, Judge Schoenthaler stated:"A smoke alarm that activates 19 minutes after smoke reaches its sensing chamber is like an airbag that deploys 19 minutes after a car accident."

16.3M was awarded in punitive damages because BRK **"failed to disclose the known limitations of the detectors to the consumers."**

Hackert vs BRK (March, 2008) (A New York State Case)

In 2003 Shelia Hackert lost her husband John Hackert, and her daughter, Christine Hackert, when the BRK **ionization smoke** alarms in their home failed to sound a timely warning in the early, smoldering stage of their fire. BRK was fined punitive damages (which is rare for a product liability suit in the State of New York). In the Summary Order the Federal Court judges stated:

" the smoke detector's failure was a legal cause of the deaths of William and Christine Hackert."

As you can decipher, there are problems with ionization alarms; they can fail to sound in a timely manner in some stages of a fire, or sound at all. They also have nuisance alarm problems which cause them to become disabled. The legislation before you will save lives.

1 **The Necessity**
of
Photoelectric Smoke Alarm Technology
NYC Housing & Building Committee
October 24, 2013

Presentation by Dean Dennis

2
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8
9 **Information Fire Officials**
Provide to the Public
(NFPA, NIST, USFA)
Everyone needs a smoke alarm.
Maintain your smoke alarm.

Ionization Alarms:
Faster at detecting flaming fires.

Photoelectric alarms:
Faster at detecting smoldering fires.

10
11 **Consumer Product Safety Commission – 'Smoke Alarms'**
Pilot Study of Nuisance Alarms Associated with Cooking
March 2010
12 **"False Alarms and Unwanted Activations"**
U.S. EXPERIENCE WITH SMOKE ALARMS
AND OTHER FIRE DETECTIONAL/ALARM EQUIPMENT – Nov. 2004
by Marty Ahrens Fire Analysis and Research Division National Fire Protection Association
Ionization Devices
A Disproportionate Share of Nuisance Alarms:

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

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

•

13 **NIST 2008**
ALARM TIMES IN SECONDS
***Results from a Full-Scale Smoke Alarm Sensitivity Study**

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

15

National Institute of Standards and Technology
Statement for the Record
To the Boston City Council Committee on Public Safety - August 6, 2007

In summary, the research conducted by NIST staff leads to the conclusion that both ionization and photoelectric alarms provide enough time to save lives for most of the population under many fire scenarios; however, ionization alarms may not always alarm even when a room is filled with smoke from a smoldering fire, exposing the most sensitive populations with mobility limitations to an undetermined risk. Photoelectric detectors can provide a lot more warning time than ionization detectors in a smoldering fire; at the same time a smoldering fires can take a longer period to become dangerous. Ionization detectors can provide a little more time than photoelectric detectors in a flaming fire; in this case there can be little time to spare. Changes in furnishing materials and construction over the past decades have reduced the time available for safe egress in any fire. NIST is currently conducting research to assess whether or not modifications may be needed in the standard test method for certifying residential smoke alarms to accommodate the changing threat.

16 **Risk Analysis of Residential Fire Detector Performance**
Larry Grosse Ph.D., Texas A&M University, Jac DeJong Ph.D. Texas A&M University, and John Murphy Ph.D., Colorado State University

17 **Residential Fire Deaths with a Smoke Alarm Present**

18

19

20

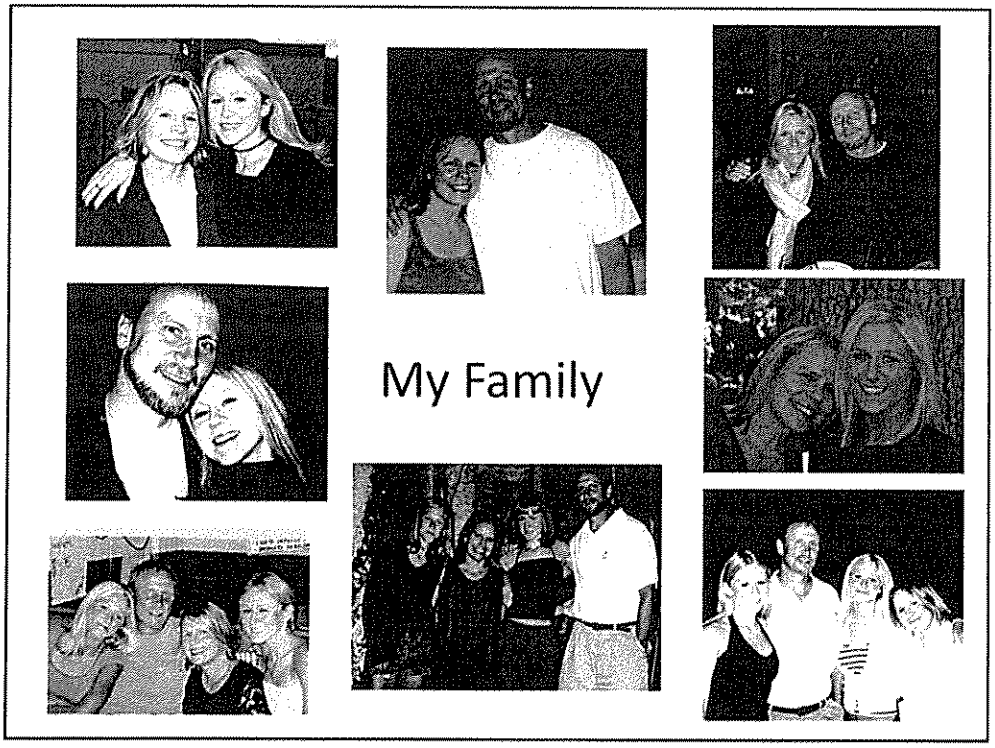
21 **THE END**

The Necessity
of
Photoelectric Smoke Alarm Technology

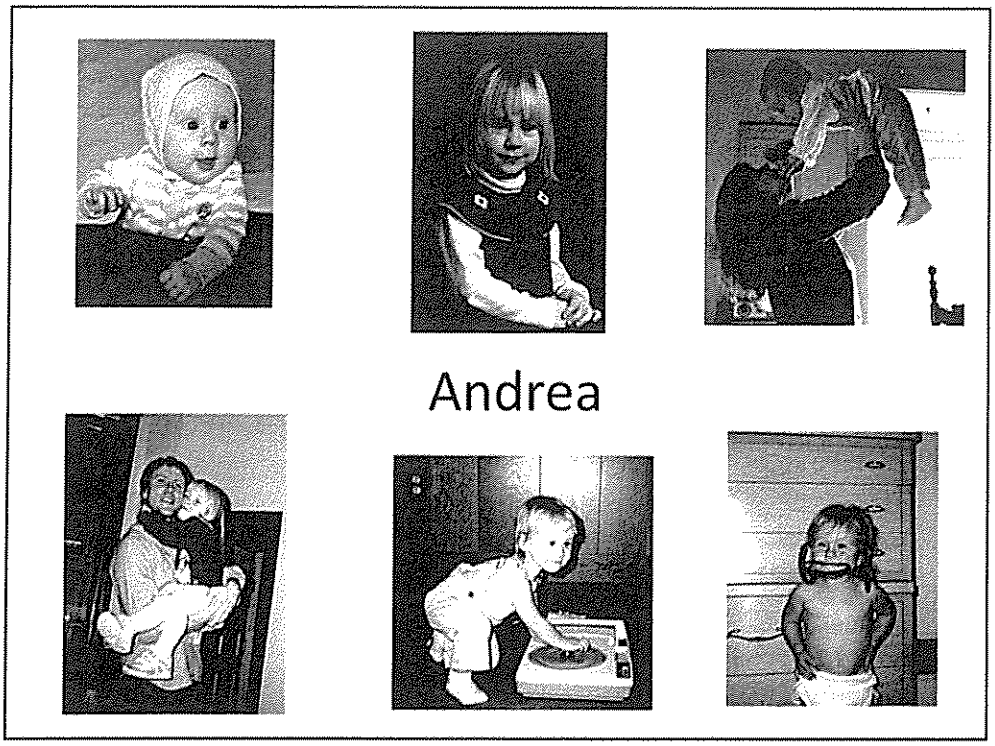
NYC Housing & Building Committee

October 24, 2013

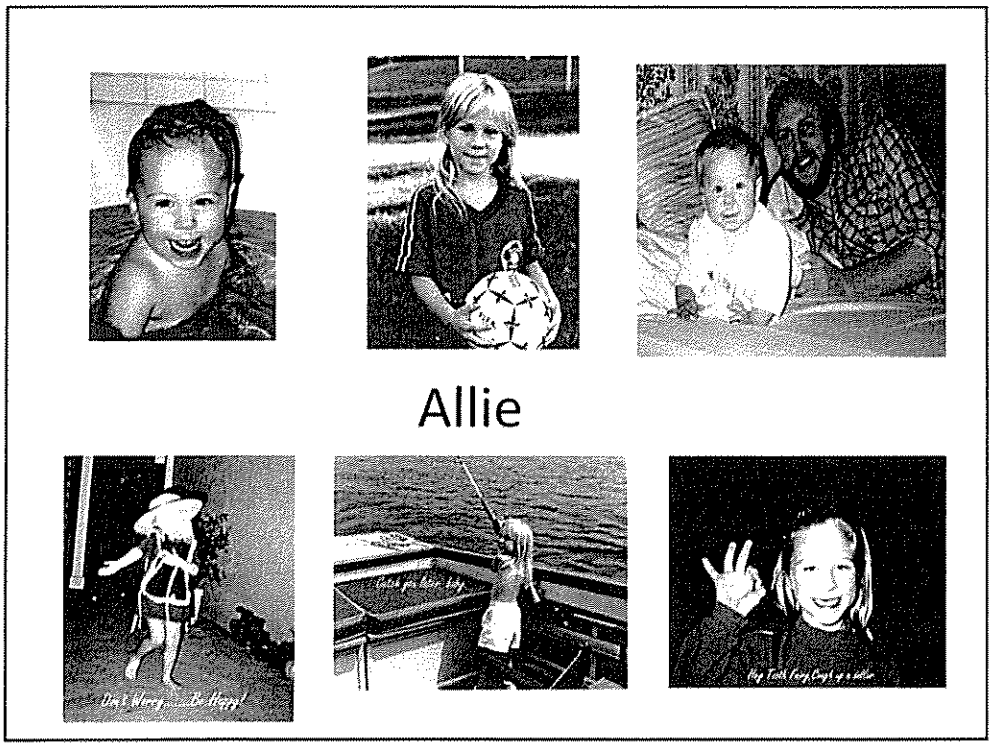
Presentation by Dean Dennis



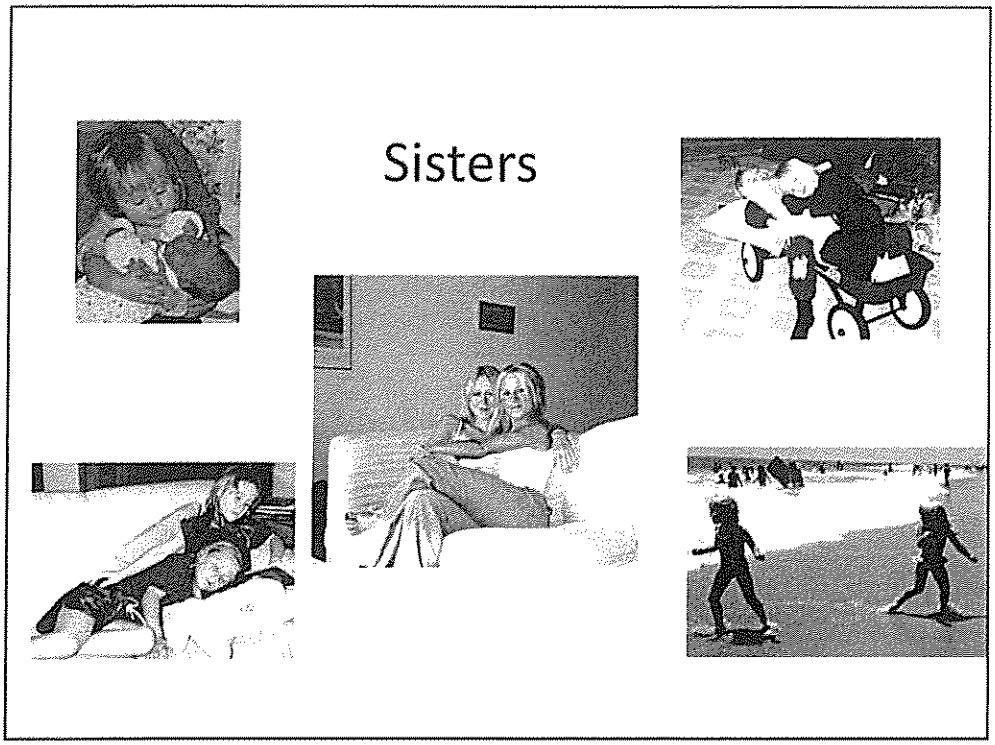
I would like for you to meet my family. My wife is Patty and my two daughters are Andrea and Allie.



Andrea was my first born. Here are pictures of her as a young child.



Allie was my second born. She is two and a half years younger than Andrea.



As you can see from the pictures, Andrea and Allie were very close. They were as much best friends as they were sisters.

Our Girls as Young Women



Both grew up to be beautiful women. The middle picture is one of Allie's senior pictures. She wanted Andrea to join her for the photoshoot.

Ohio State University Fire

April 13, 2003

We lose Andrea

This is when we lost Andrea. She went with her friends to a party at Ohio State. If she hadn't gone to bed early, she likely would have made it out of the house.

The Aftermath

Andrea died along with 4 other students. The house was equipped with approximately 6 ionization alarms. Two years later, 3 more students died at Miami University in Ohio. This house had more than a dozen hard-wired ionization alarms. It is thought that by the time the first detector sounded, the students were already dead. A disturbing call from a Boston deputy fire chief was received after this fire.

Andrea was one of 5 students that died. Two years later, almost to the minute, 3 more students died at Miami of Ohio. Between the two fires there were believed to be more than 20 ionization smoke alarms. Many were disabled and in the Miami fire they didn't respond in time to a fire that likely smoldered for over an hour.

Information Fire Officials Provide to the Public

(NFPA, NIST, USFA)

Everyone needs a smoke alarm.
Maintain your smoke alarm.

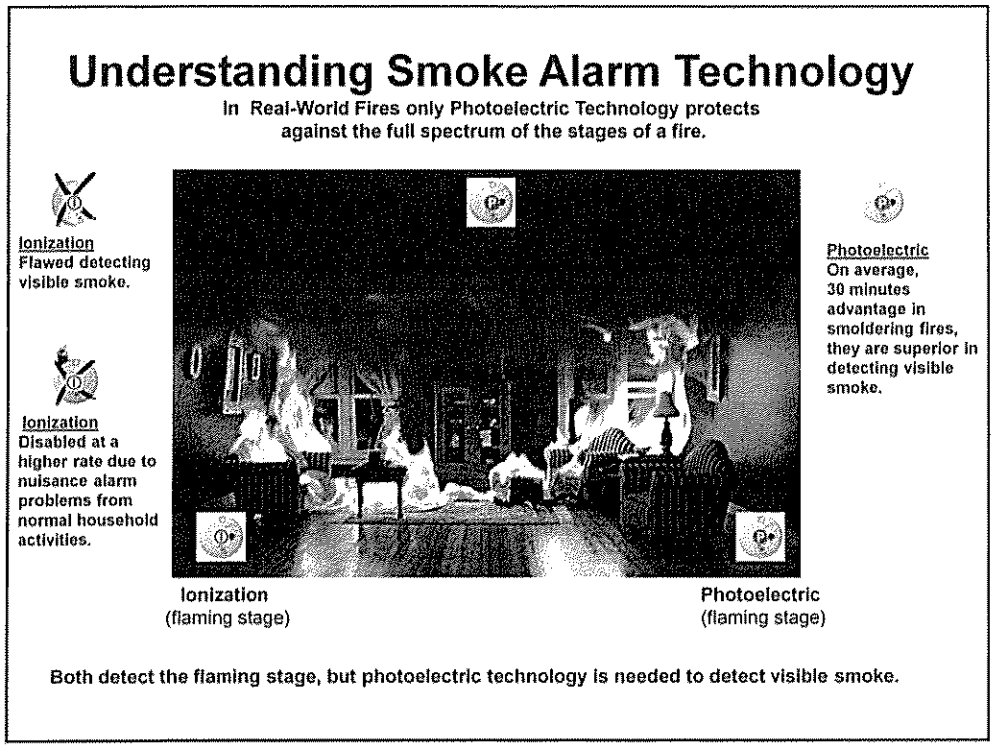
Ionization Alarms:

Faster at detecting flaming fires.

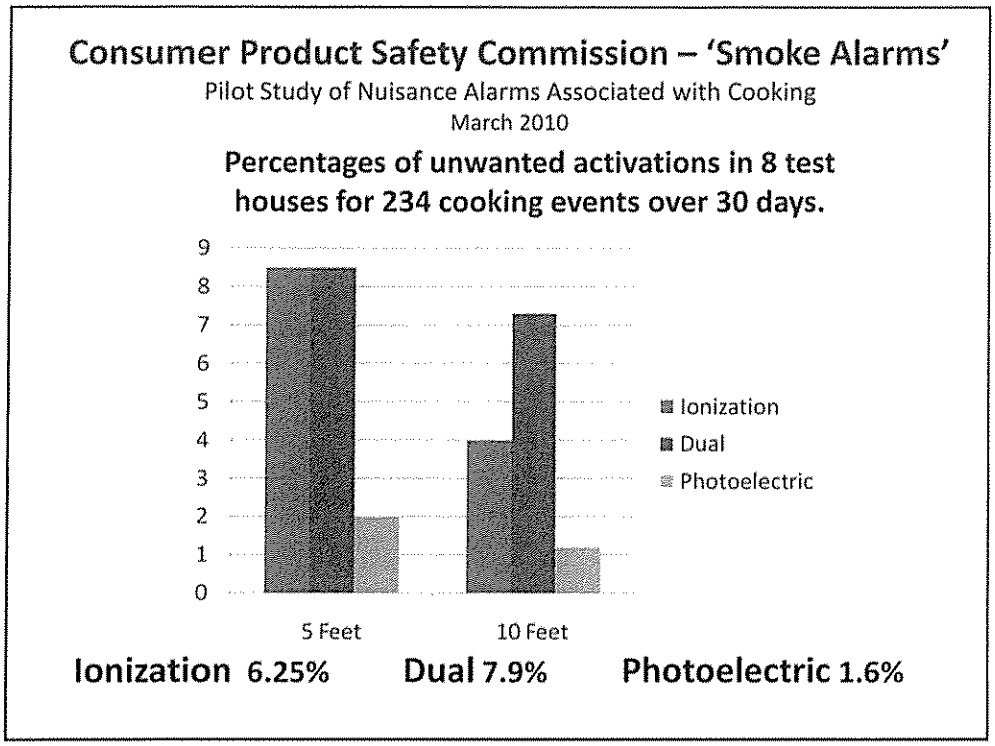
Photoelectric alarms:

Faster at detecting smoldering fires.

Fire officials tell you to buy and maintain a smoke alarm. They know very little about the two technologies. They know a ionization is faster in a flaming fire and a photoelectric is faster in a smoldering fire. They have little understanding as to the time differences. They don't know that ionization alarms can fail in cool smoke.



Ionization alarms react to sub-micron particles. This makes them good at detecting the combustion or flaming stage of a fire. However, this also makes them problematic to nuisance alarm problems. They are flawed at detecting visible smoke. Photoelectric alarms are good for the full spectrum of fires and have minimal nuisance problems.



CPSC study found that outside of 20 feet from a cooking nuisance source both technologies was acceptable. Inside 20 feet photoelectric technology had the fewest unwanted activations.

"False Alarms and Unwanted Activations"

U.S. EXPERIENCE WITH SMOKE ALARMS
AND OTHER FIRE DETECTIONAL/ALARM EQUIPMENT – Nov. 2004
by Marty Ahrens Fire Analysis and Research Division National Fire Protection Association

Ionization Devices

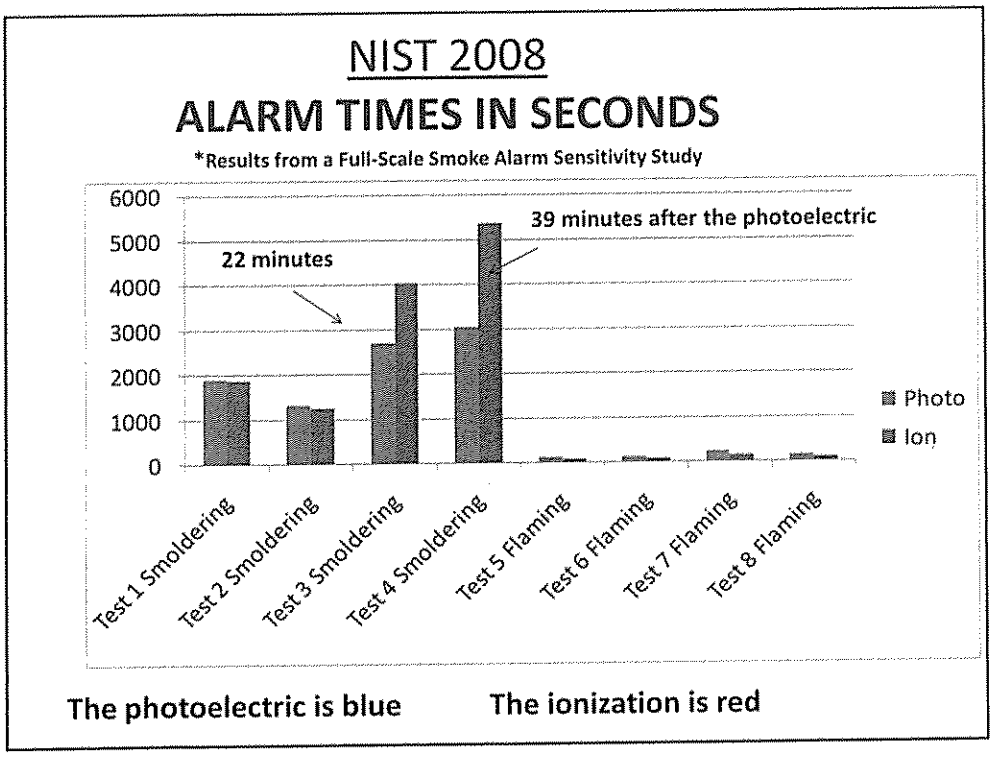
A Disproportionate Share of Nuisance Alarms:

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

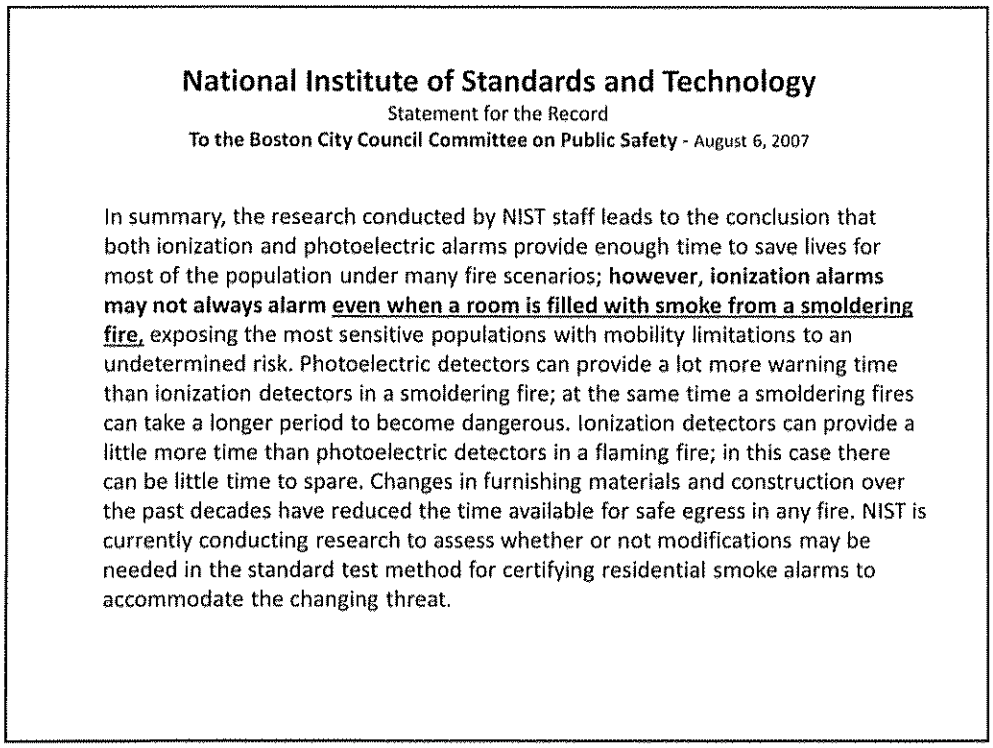
Most people do not automatically assume a sounding smoke alarm is an emergency situation. In some cases, they know what caused the alarm and know that they are safe. However, lives have been lost when real alarms were mistakenly considered false. **Unwanted activations can generate a dangerous sense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

Here is the NFPA, "False Alarms and Unwanted Activations" study that cites that 97% of nuisance alarms problems are from ionization alarms. Cooking activities are the primary reason. There is a concern expressed by the NFPA that unwanted activations can generate "a dangerous sense of complacency."

They also were concerned that the "unwanted activations could cause a dangerous sense of complacency."



The Photo SD are blue, the Ions SD are red. To the left is the time in seconds that it took the alarms to sound. In the flaming tests they look like they sounded the same, but the ionization alarms actually averaged about 30 seconds faster ("slightly better"). The real difference is in the smoldering tests. In test #4 you have a scenario where smoldering fire starts in a chair with high density foam and the alarms are located in the hallway to the bedroom and the door is open. You see almost a 40 minute difference (considerably faster).



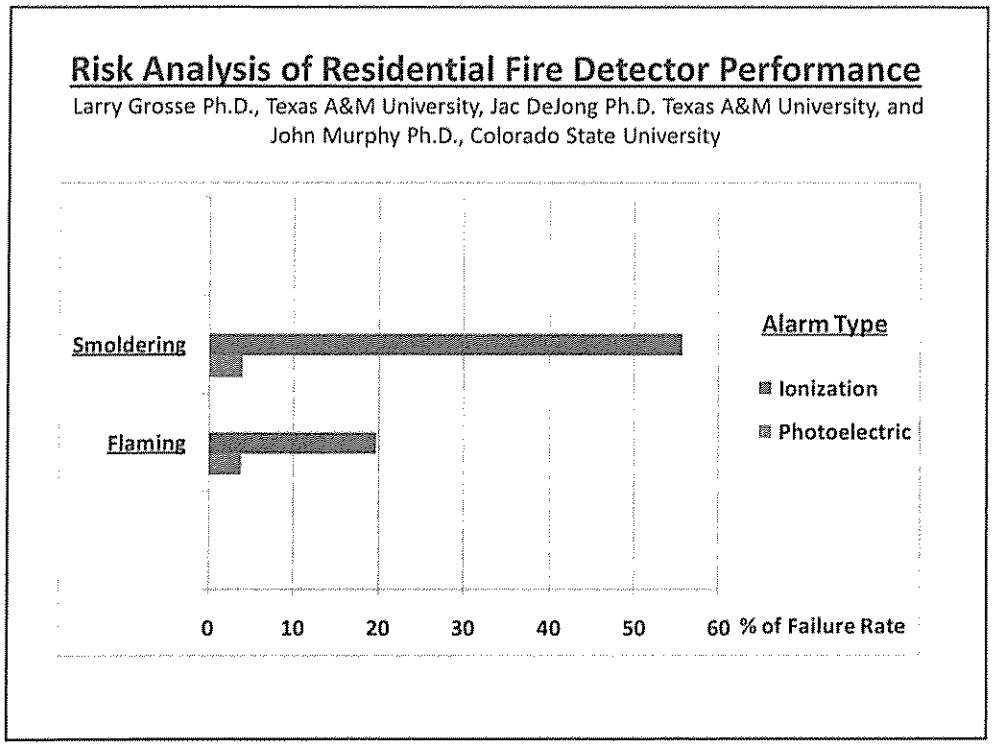
National Institute of Standards and Technology

Statement for the Record

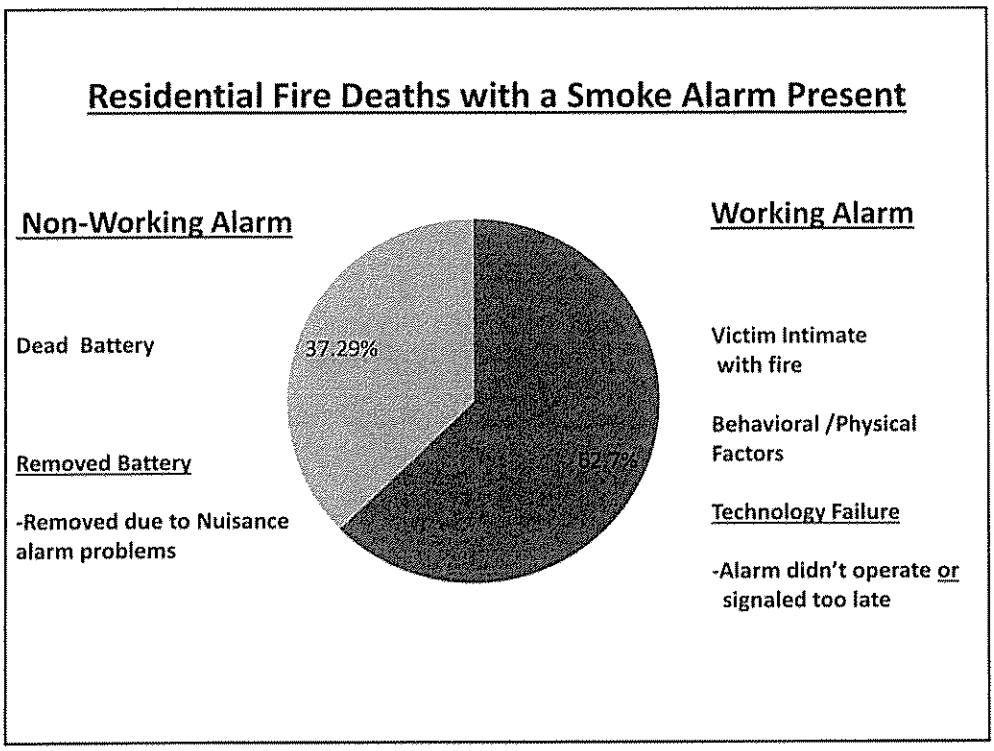
To the Boston City Council Committee on Public Safety - August 6, 2007

In summary, the research conducted by NIST staff leads to the conclusion that both ionization and photoelectric alarms provide enough time to save lives for most of the population under many fire scenarios; **however, ionization alarms may not always alarm even when a room is filled with smoke from a smoldering fire,** exposing the most sensitive populations with mobility limitations to an undetermined risk. Photoelectric detectors can provide a lot more warning time than ionization detectors in a smoldering fire; at the same time a smoldering fires can take a longer period to become dangerous. Ionization detectors can provide a little more time than photoelectric detectors in a flaming fire; in this case there can be little time to spare. Changes in furnishing materials and construction over the past decades have reduced the time available for safe egress in any fire. NIST is currently conducting research to assess whether or not modifications may be needed in the standard test method for certifying residential smoke alarms to accommodate the changing threat.

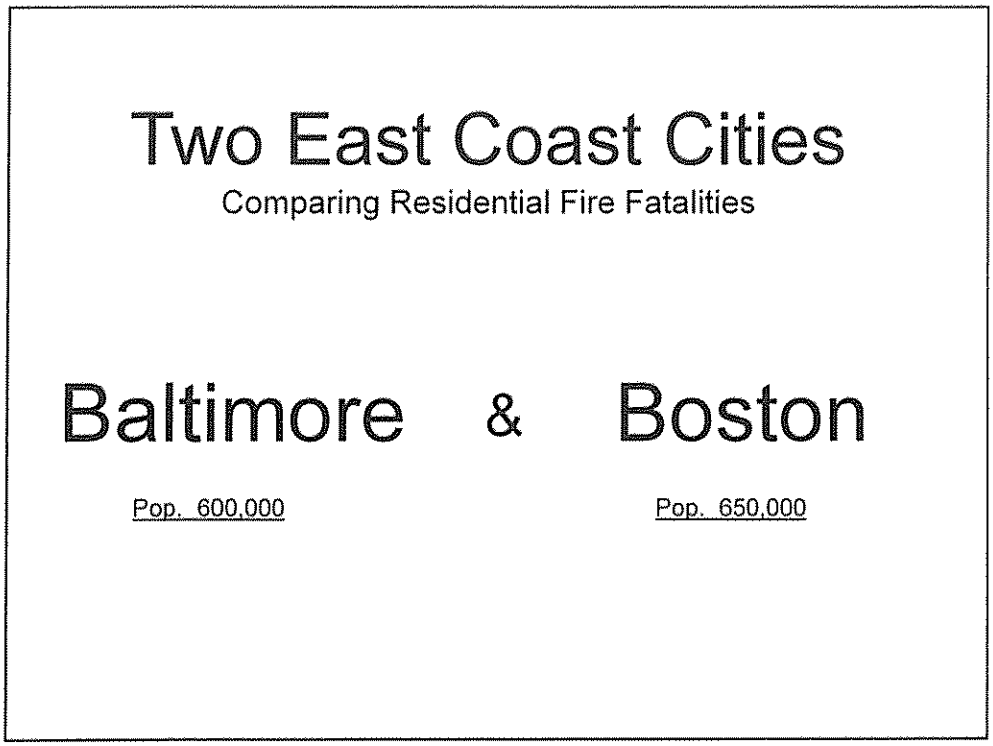
NIST admits in some of their testing, that "ionization alarms may not always alarm even when a room is filled with smoke from a smoldering fire."



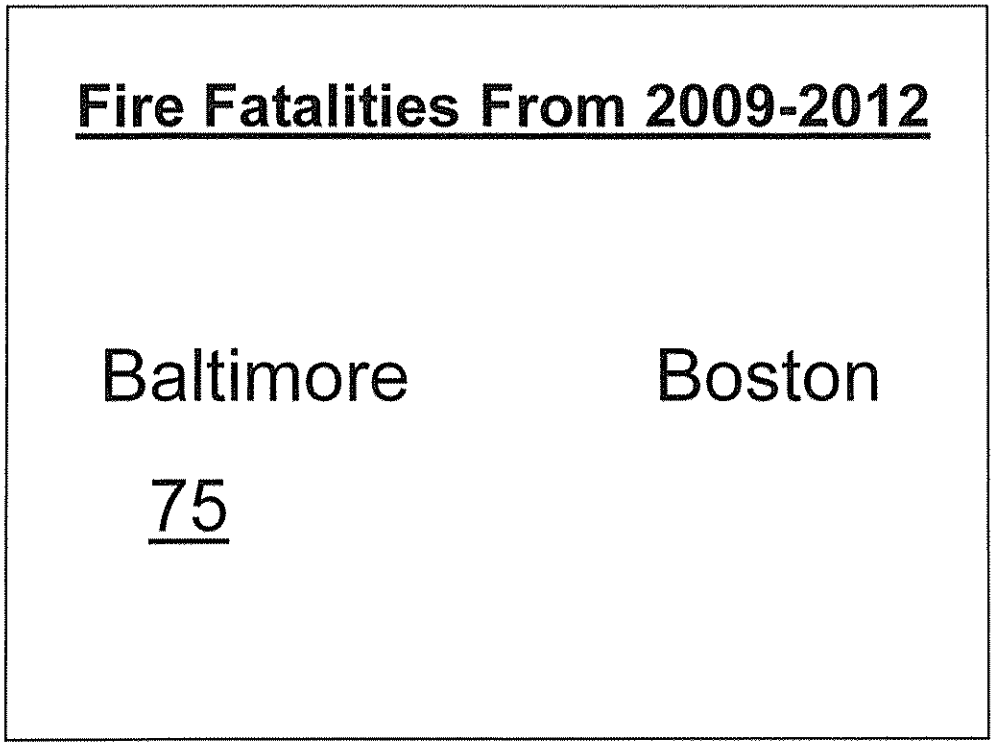
In a well designed Texas A&M study it was found that photoelectric alarms allowed a 96% chance of surviving all fires while ionization alarms allowed a 46%-81% chance depending on the stage of the fire.



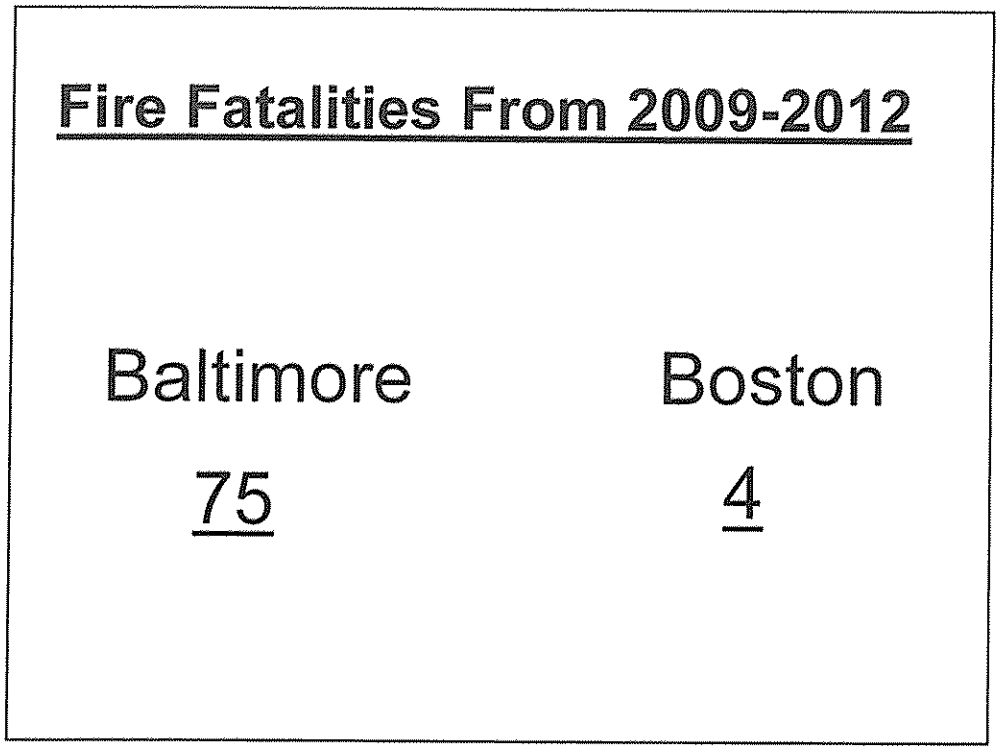
We know that ionization alarms get disabled more than photoelectric alarms and that ionization alarms have trouble detecting cooler smoke. This chart shows the percentages of people who purchased a smoke alarm, yet died. Of the more than 2,000 people, how many more would be alive if they had photoelectric alarms?



Boston and Baltimore are two like cities. Boston however has a strong culture of photoelectric smoke alarms. For over 20 years the Boston Fire Department only passed out photoelectric alarms. In MA, photoelectric technology is required. In Baltimore the message is just to have a smoke alarm with the UL seal on it.



Here are the number of fatalities in Baltimore over a four year period. How many do you think Boston had, it has 50,000 more people and a colder climate?



The answer is 4. This is because they have a culture of educating their population and they mandate photoelectric smoke alarms. They are the city with the fewest fatalities in the United States. All cities and states need to require photoelectric alarms.

THE END

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Presented By
Skip Walker

Smoke Alarm Legislation Committee Hearing Int. 863 & 1111
October 24, 2013

New York City Building and Housing Committee
Photoelectric Smoke Alarms

American Society of Home Inspectors

California Real Estate Inspection Association

Both Have Strong Position Statements Endorsing Photoelectic Smoke Alarms
Modeled After IAFF Position

New York City Building and Housing Committee
Photoelectric Smoke Alarms

It Is ASHI and CREIA Belief That Strong National Photoelectric Alarm Legislation Can Reduce The US Fire Death Rate By 40% Or More

New York City Building and Housing Committee
Photoelectric Smoke Alarms

What New York City Does On This Issue Not Only Impacts NYC Residents.... It Has Broad National Implications

New York City Building and Housing Committee
Photoelectric Smoke Alarms

- From a fire safety 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*

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Number of Households in The Us with Smoke Alarms:

1960: Almost Zero
1977: 18 Million/22%
2007: 111 Million/96%

Source: NFPA, Smoke Alarms in US Fires 2011

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Photoelectric Smoke Alarms

Number of Households in The Us with Ionization Smoke Alarms:

Approximately 90%-95%
100-105 Million Homes

Source: Industry Sales Figures/Research Report Estimates

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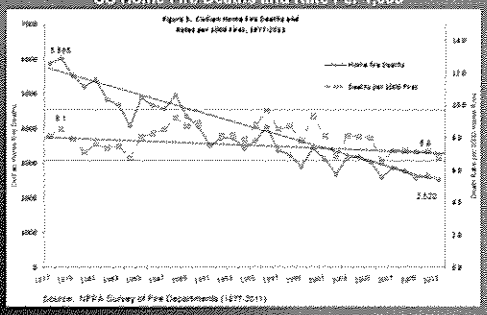
Deadly Differences
Ionization vs Photoelectric Smoke Alarms

US Home Fire Deaths and Rate Per 1,000



Source: NFPA Fire Loss 2011

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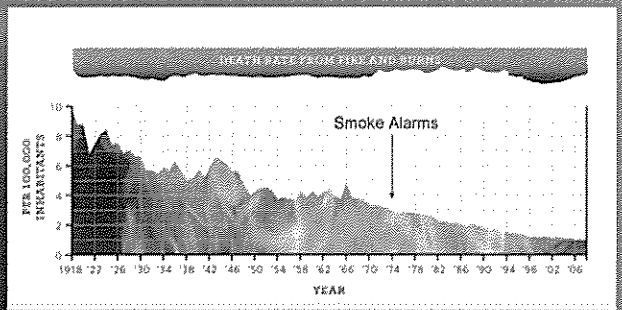
Photoelectric Smoke Alarms

Fire Deaths 1918-2006



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Photoelectric Smoke Alarms

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

"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 2011

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Photoelectric Smoke Alarms

All Fires Do Not Carry The Same Risk Of Death

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Cooking/Fast Flame Fires Account for:

42% of Fires, **37%** of Injuries and **15%** of Deaths

Smoldering Fires Account for:

23% of Fires, **29%** of Injuries and **61%** of Deaths

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Photoelectric Smoke Alarms

Time of Day Matters

- 37% of Fires Occur Between 8 PM & 8 AM
- 66% of Fire Deaths Occur Between 8 PM & 8 AM

Source: NFPA Home Structure Fires 2011

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Roughly *Two-Thirds* of Fire Deaths Occur In Homes With *No* Functional Smoke Alarm

- Yet 96% of US Homes Have at Least One Alarm
- Roughly 50% of Homes With Intentionally Disabled Alarms Cite Nuisance Trips As The Reason
- Studies Show That Ionization Alarms Account for Almost All Nuisance Alarms

New York City Building and Housing Committee
Photoelectric Smoke Alarms

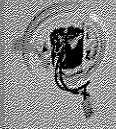
In Other 50% Of Homes With No Functional Smoke Alarm

- Dead/Missing Batteries
- Other Power Source Issues
- Electronic Failure: Roughly 3% Per Year Compounded

New York City Building and Housing Committee
Photoelectric Smoke Alarms

If Dead Batteries Are Such A Problem, What About 10 Year Batteries and Anti-Tamper Alarms?

- Without Eliminating Nuisance Tripping Issues, Alarms Will Simply Get Removed As Hardwired Alarms Do Now



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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Center for Disease Control (CDC) SAIFE Program 10 Year Study on Lithium-Ion 10 Year Batteries

"Eight to ten years after the installation of the lithium powered smoke alarms, the inspectors found that one-third of the alarms were still functional"

37% of the installed alarms were missing
30% of the alarms were present but not functioning
Of the 180 present but not functional, 43% had a dead battery, 17% had no battery, 13% appeared nonfunctional because of physical damage, remaining
27% were non-functional for other reasons, missing parts, dust accumulation, etc.
38% of the dwellings had at least one of the originally installed alarms functional
30% of the dwellings had all of the originally installed alarms still functional.
In 34% of the dwellings, all of the originally installed alarms in the home were missing.

Source: Evaluation of Fire Safety Programs That Use 10 Year Smoke Alarms. J Community Health (2010) 35:543–549

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Dallas Alarm Evaluation: Operation Installation

"Although lithium-powered alarms are supposed to function for 10 years, it was apparent from our follow-up testing that they do not. Although >90% of the programme houses had at least one working smoke alarm at the 2-year follow-up sample, that proportion was down to 20% for the 10-year sample."

This community-based smoke alarm installation programme was highly effective for residents of houses that received a smoke alarm, for the first 5–6 years after installation, but its efficacy declined substantially after that time.
- Most cases of house fire-related deaths and injuries in programme houses occurred in houses where the programme smoke alarm either did not work, or had been removed.
- Based on this data, smoke alarm installation programmes may not be able to plan on efficacy remaining high for the full 10 years that lithium powered alarms are advertised to work.

Source: Preventing deaths and injuries from house fires: an outcome evaluation of a community-based smoke alarm installation programme. Injury Prevention, July 2013

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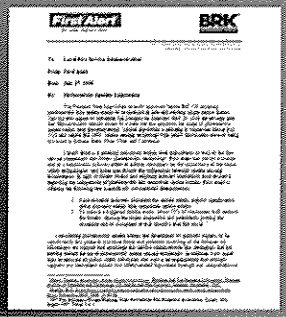
Photoelectric Smoke Alarms

BRK/First Alert Letter to Vermont Fire Dept's



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Photoelectric Smoke Alarms

BRK/First Alert Letter to Vermont Fire Dept's

In light of recent studies and ongoing industry performed field research regarding the comparison of photoelectric and ionization alarms, First Alert is offering the following two scientifically substantiated determinations:

- *Field research indicates photoelectric smoke alarms exhibit significantly fewer nuisance alarms that ionization alarms.* [1,2]
- *To silence a triggered alarms, 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]

"...we support and encourage fire service administration and lawmakers that are moving toward the use of photoelectric smoke sensing technology".

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Photoelectric Smoke Alarms

The Key To Reducing Deaths In The Two-Thirds With "*No Functional Alarm*"

Is To Reduce Nuisance Trips

and Keep Power To The Alarm

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Photoelectric Smoke Alarms

Smoke Alarms/Detectors in Residential Construction

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

Ionization

Photoelectric

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Ionization Alarms:

- About 90-95% of Alarm Installs in US
- Very Prone to Nuisance Trips; Showers, Cooking, Etc
- Very Slow at Detecting Smoldering/Fatal Fires
  - Average 30 Minutes Slower, Range 15-90 Minutes
- Can Fail Outright to Alarm in 1 of 5 Smoldering Fires
- Slightly Faster for Flaming Fires
  - Average 50 Seconds

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Photoelectric Smoke Alarms

Ionization Alarms:

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  - Average 50 Seconds

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Photoelectric Smoke Alarms

Photoelectric Alarms:

- 5% or Less of Alarm Installs in US
- Virtually No Nuisance Trips; Studies Show As Little as 3%
- Significantly Faster at Detecting Smoldering/Fatal Fires
  - Average 30 Minutes Faster, Range 15-90 Minutes
- Slightly Slower in Flaming Fires
  - Average 50 Seconds

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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	3804	64.6	73.6	3752	72.3	79.1
Bread – 4 slices	12133	319	66.1	98.0	361	45.9	55.5
	12155	306	71.5	99.4	371	41.5	45.8
	01244	343	75.8	98.5	419	28.4	19.4

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

This Is The Test and Material They Are Required to Pass to Be Sold

Ion's Responded Average of 22% Faster to Burnt Toast

UL Smoke Characterization Study, 2007, Page 109, Table 25

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Mattress PU foam – 100 × 125 × 100 mm foam with a 35 × 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

UL Smoke Characterization Study, 2007, Page 109, Table 25

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

The Key To Reducing Deaths In The One-Third With "*Functional Alarms*"

Is To Have Alarms That Stay Connected and Respond Faster in Real World Fatal-Fire Scenarios, i.e., Smoldering Fires

Only Photoelectric Alarms Can Do This.....

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Photoelectric Technology Laws In Place In:
Massachusetts
Vermont
Maine
Rhode Island
Iowa

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Photoelectric Smoke Alarms

In Ohio, Photoelectric Technology Ordinances Are In Place In 8 Cities, Including Cincinnati

In California, Photoelectric Technology Ordinances Are In Place In 4 Cities

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Pending Averyana's Law, New York

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

"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."

Legislation will provide tax incentives for purchase of photoelectric alarms.

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

International Association of Fire Fighters:

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

IAFF Represents Around 300,000
Fire Fighters in US & Canada

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New York City Building and Housing Committee
Photoelectric Smoke Alarms

Both California Real Estate Inspection Association
And
American Society of Home Inspectors

Official Position Supporting Photoelectric Only Technology
Specifically States, No Combination Detectors

Both Mirror IAFF Position

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New York City Building and Housing Committee
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*
- *Requiring 10 Year Anti-Tamper Alarms Alone Cannot Fix The Problem*
- *Changing to Photoelectric Alarms Would Save At Least 1,000 Lives Civilian Per Year and Reduce Risks to Fire Responders*
- *No Alarm Can Save Everyone – But We Can Do Much Better*

New York City Building and Housing Committee
Photoelectric Smoke Alarms

Questions
And
Comments!

Smoke Alarms:

The Fire That Started It All

Smoke Alarms: The Fire That Started It All

Introduction

Russell Ashe

- Barre City Fire And Ambulance
  Captain / EMT – I (retired)
- E. Montpelier Fire and Amb
  Fire Fighter / EMT - I
- Williamstown Fire Department
  Fire Fighter
  - Fire Service for 23 Years

Barre City Fire Department

18 - Full Time Firefighter (IAFF Local 881) & 20 - Call Firefighters
City Population - 9600
4 Duty Shifts - Rotation of 24 Hours ON DUTY 72 Hours OFF DUTY
EMS LEVEL - Intermediate - Paramedic

What Got Us Started ?

December 17, 2005

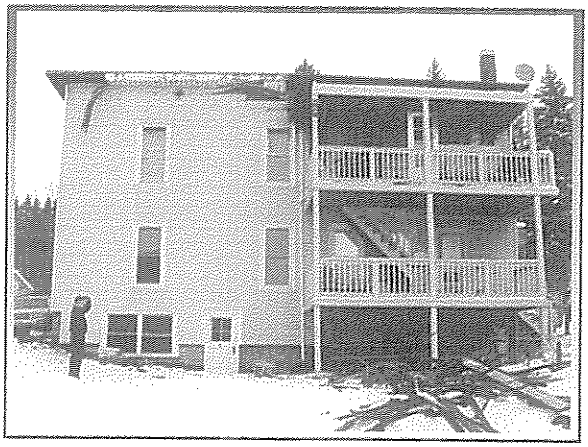
Eastern Ave.

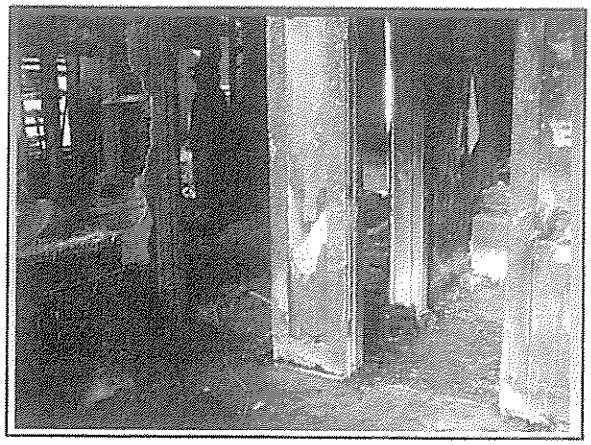
7 people in the home at the time of the fire.

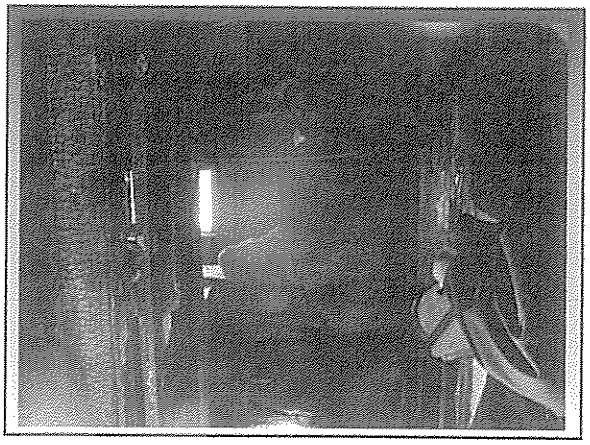
1 Adult male was able to escape by reportedly jumping out of a second floor window.

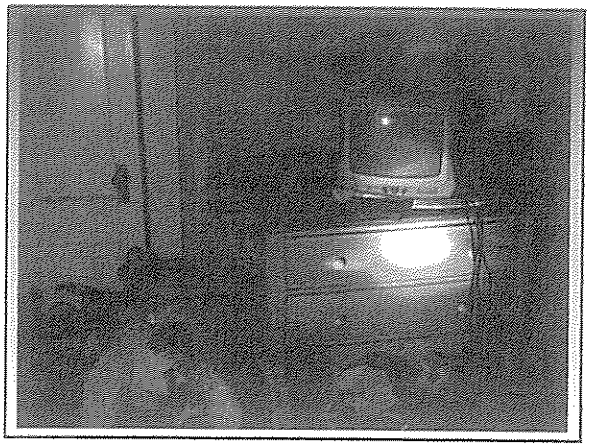
Fire Crews rescued 4 Children and the Father before being consumed by fire.

Tragically the 4 children and there mother died from smoke inhalation.









Point of Origin

Possible Causes:

Smoking Material, Christmas Decorations, or Unattended Candle

Investigation

According to a male survivor - the smoke in the apartment was so heavy he was forced to jump from a second floor window.

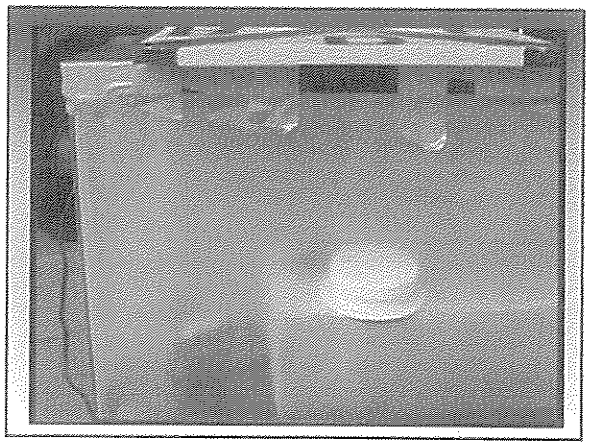
The male victim that escaped reported that he heard no smoke detectors going off while he was in the apartment.

The apartment had 3 HARD WIRED IONIZATION smoke detectors
(1 in the Master Bedroom, 1 in the Girls Bedroom, and 1 in the main family room)

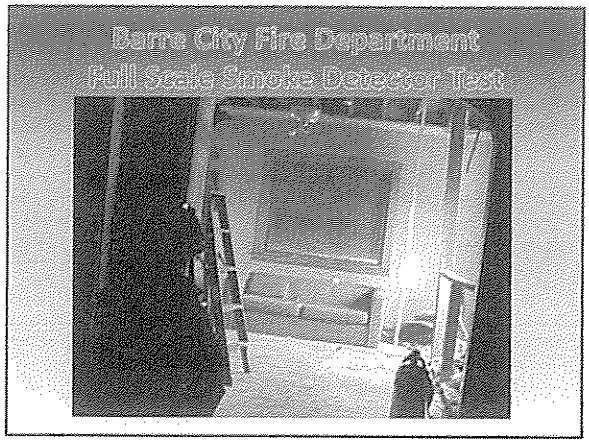
All smoke detectors on the first floor were found to be in working order by firefighters after the fire was extinguished.

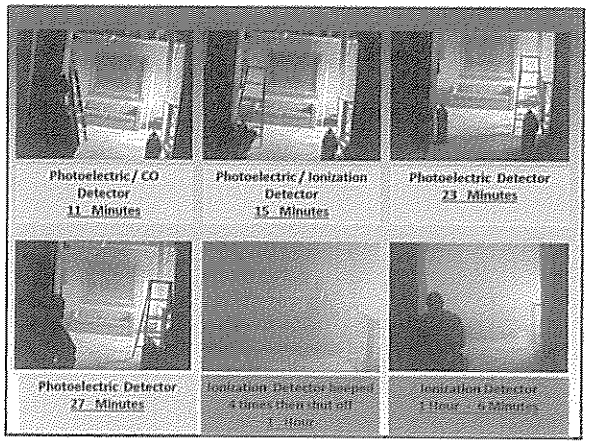
The apartment building had passed a city minimum housing inspection only a few months before this fire.

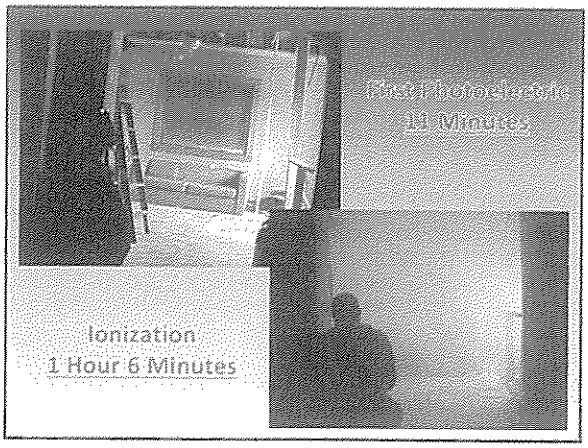
What Happened?
Why Did The Alarms Not Go Off?



A fish aquarium
is NOT
a real representation
of a house fire ! ! ! !


Barre City Fire Department
Full Scale Smoke Detector Test


Photoelectric / CO Detector
11 Minutes
Photoelectric / Ionization Detector
15 Minutes
Photoelectric Detector
23 Minutes
Photoelectric Detector
27 Minutes
Ionization Detector beeped 4 times then shut off
1 Hour
Ionization Detector
1 Hour 6 Minutes


Photoelectric
11 Minutes
Ionization
1 Hour 6 Minutes

S.226

Winter of 2007 / 2008, Senate Bill 226 is introduced and debated, requiring ***Photoelectric Only*** smoke alarms to be installed in all new single family dwellings and any existing single family dwellings sold.

Photoelectric Only smoke alarms would be required in the area of the bedrooms and at least one per floor.

May 2008

Senate Bill 226 is signed into law requiring Photoelectric only smoke alarms

LET US NOT FORGET THE TRUE HERO'S

OHIO STATE UNIVERSITY
APRIL 13, 2003

ANDREA DENNIS
KYLE RAULIN
AL SCHLESSMAN
ERIN DEMARCO
CHRISTINE WILSON

SCOTCHTOWN, TASMANIA
APRIL 2004

JOSHUA COHEN
CLAIRE POKE
TAYLA BRAID
DANNI WIGG

MIAMI UNIVERSITY
APRIL 10, 2005

JULIE TURNBULL
KATE WELLING
STEVE SMITH

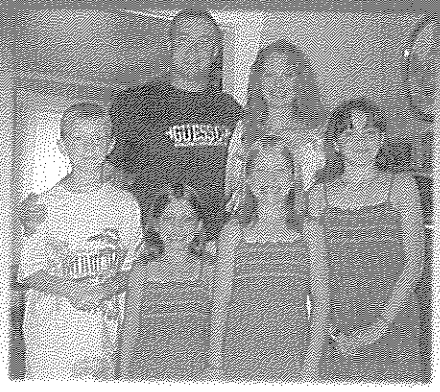
AUBURN, NY
MARCH 11, 2012

AVERYANA DALE (2)
RACHEL HARRIS-CURIONE (38)

AVERYANA'S LAW

BARRE CITY, VERMONT
DECEMBER 17, 2005

BRETT STOLTZ (10)
TORY STOLTZ (11)
CHRISTA FOSTER (8)
KIMBERLY STOLTZ FOSTER (30)
MIKAYLA FOSTER (6)



Are Ionization Smoke Alarms Defective?

Part 1: WFSF Document

to NYCC:

from WFSF:

WFSF Testimony re NYCC Housing & Buildings Committees Proposed Legislation Requiring Photoelectric Smoke Alarms in Residential Buildings.

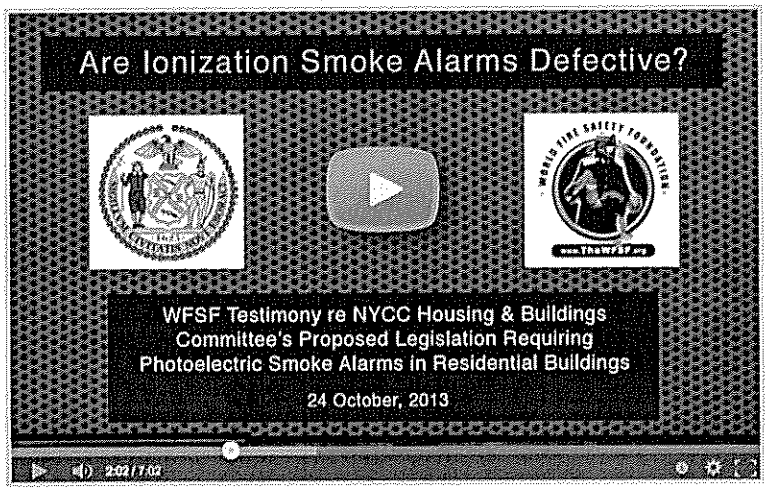
Int No. 865 & Int No. 1111 | 24 October, 2013

Part 1: This Document, and Part 2: Video Presentation:

SmokeAlarmWarning.org/ny.html

Part 1:
Written Testimony

Part 2:
Video Testimony



Written & Video Testimony:

SmokAlarmWarning.org/ny.html

Thursday, 24 October, 2013

Council Member Elizabeth Crowley & Co-Sponsors
Committee on Housing and Buildings
250 Broadway, Suite 1765, New York, NY 10007, USA

Re: Int. Nos. 865 & 1111 Proposing Legislation to Mandate Photoelectric Smoke Alarm Technology in Residential Accomodation in New York City

Dear Council Members & Co-Sponsors

The World Fire Safety Foundation (WFSF) was founded in March 2000 to expose the known and life-threatening limitations of ionization smoke alarm technology and advise of the safe and proven alternatives. We are a not for profit organization. We do not sell anything, solicit or accept donations.

In the late 1990's, Karl Westwell and myself, the Co-Founders of the WFSF ran an award-winning franchise which sold tens of thousands of ionization smoke alarms to consumers across Australia and New Zealand. I am a former full-time fire fighter and have run several large campaigns over the past 30 years. In our video testimony (see link below) you will hear how several of our clients discovered that whilst their ionization alarms would activate when cooking, they remained silent when they had a real-world fire in their home.

By 1999 we knew there was a serious problem and that we had a Duty of Care to find a solution. In early 2000 we discovered what we were looking for; an award-winning documentary which aired on national Canadian TV. 'Silent Alarms' was based on the Mercer v BRK Pittway Corp law suit. Bradley Mercer died in a house fire in January 1993. His home in Iowa was fitted with new ionization smoke alarms. His brother Travis suffered horrific burns to 40% of his body. When awarding $16.3 million dollars in punitive damages, the judge said the manufacturer, *"failed to disclose the known limitations of the detector to the consumer."* Earlier this year, on the twentieth anniversary of Bradley's death, his mother Jennifer told me the fire department in Iowa are still passing out ionization alarms.

For over ten years the Foundation has fought years of misinformation to expose the truth out about ionization smoke alarms. Is it possible to make a definitive answer on how to best protect the citizens of New York city? Yes, absolutely. Empirical scientific evidence proving beyond any doubt that ionization alarms should never have been allowed to pass any fire safety standards is available.

The Commonwealth Scientific and Industrial Research Organization (CSIRO) and all manufacturers who have had their ionization smoke alarms tested to the Australian Smoke Alarm Standard hold the documented evidence that proves unequivocally that ionization smoke alarms are dangerously defective. Within this document you will see how a member of the Australian Parliament has spoken in Parliament about how the manufacturer of the smoke alarm in his own home will not disclose critical information about their ionization alarms. As at the date of this letter the CSIRO still refuses to allow us to film theiur testing of these devices.

Please examine the contents of this document which together with the accompanying video contains the information you seek. Your council has done an exemplary job with your proposed legislation to mandate the use of photoelectric smoke alarms in homes in your city. Thank you for the opportunity to present this information to you and I look forward to meeting some of you in person when I come to New York next June.

Thank you.

Sincerely,

The World Fire Safety Foundation
Adrian Butler
Chairman, Co-Founder, Former Firefighter

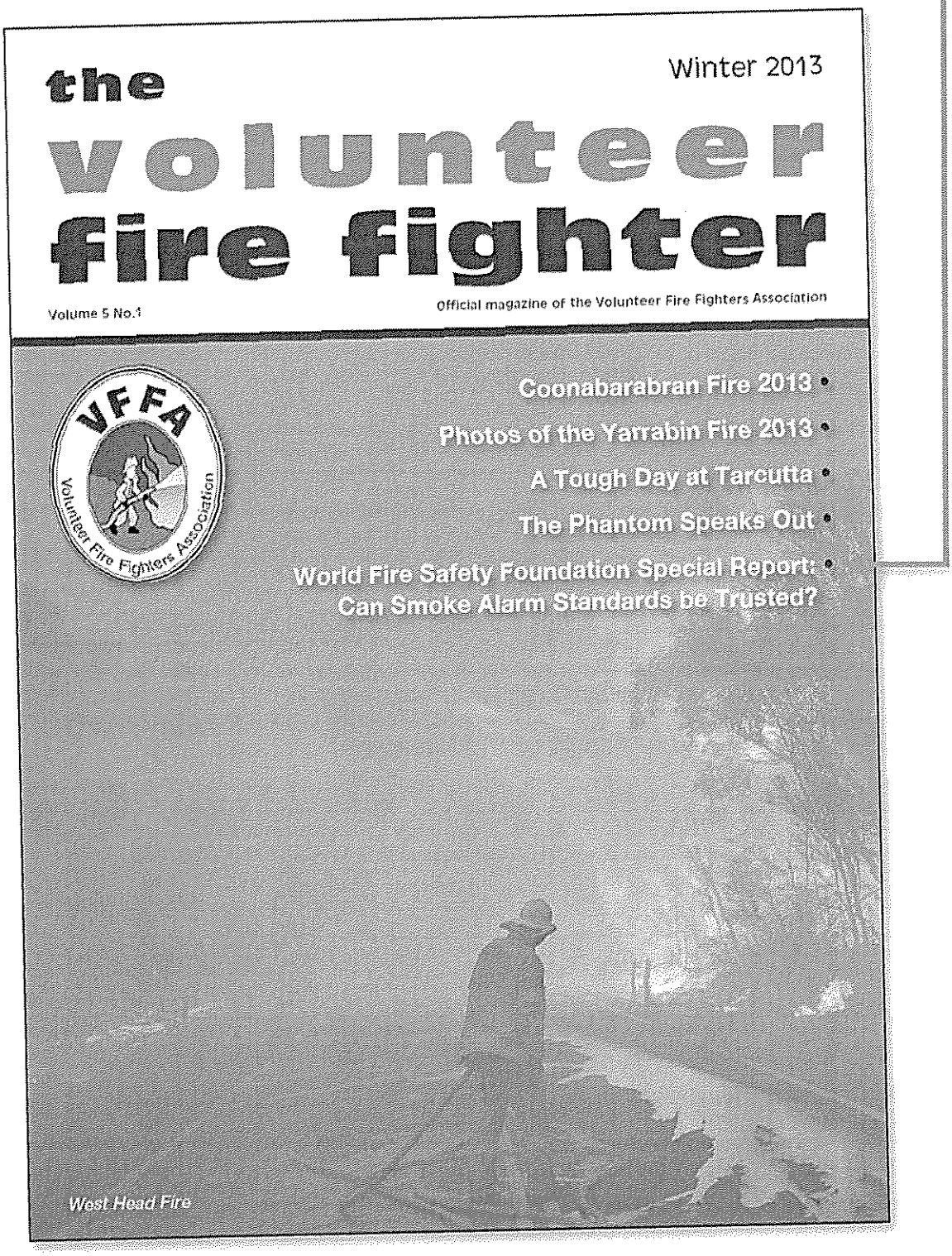
Written & Video Testimony:
www.SmokAlarmWarning.org/ny.html

Can Australian and US Smoke Alarm Standards be Trusted?

Part 1 - May, 2013

This World Fire Safety Foundation special report has been extracted from the Winter (May) 2013 edition of Australia's Volunteer Fire Fighter Association's (VFFA) quarterly magazine.

The Foundation thanks the (VFFA) for permission to reproduce this report.



Can Australian and US Smoke Alarm Standards be Trusted?

A Special World Fire Safety Foundation Report

Australia's Double Standard

Note: There are two completely different *types* of smoke alarms:
Ionization and Photoelectric - both can be either battery or hard-wired.

- The Ionization *type* are in most homes.
- The Photoelectric *type* are in most commercial buildings.

May 2004: Photoelectric alarms made mandatory in new commercial buildings.
Feb 2006: Discovery made that ionization alarms in most Australian homes do not activate until *"dangerously high"* levels of smoke. Why was the correction to the Australian Smoke Alarm Standard blocked?

(See The C.A.N. Report on page 3).

Darren Curtis
Senior Reporter, Channel 9 News
Brisbane, Australia. May 2011

"...the ionization alarms have failed* Australian Standards since 1993."

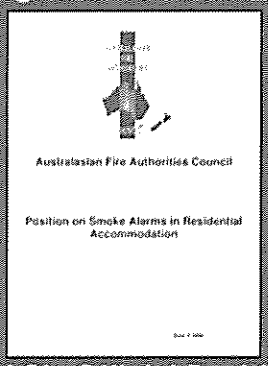
*Unable to pass CSIRO scientific tests for visible smoke.

In May, 2011 a stunning statement was made about the ionization type of smoke alarm installed in hundreds of millions of homes around the world.

They have been unable to pass Australian Government (CSIRO) scientific tests for visible smoke since 1993.

Is this the catalyst for a global ban and recall?

Australian & N.Z. Fire Brigades Make a Stand



AFAC's Official Position

"That all residential accommodation be fitted with photoelectric smoke alarms."

Australasian Fire & Emergency Service Authorities Council's (AFAC) official position on smoke alarms. June 2006

AFAC is the peak representative body of all Australian & New Zealand Fire Brigades.

www.theWFSF.org/afac

We frequently turn on lights, fasten our seat belts, hop in elevators and fall sleep at night protected by our smoke alarms - without giving a second thought as to whether these devices are safe. Why should we? Most products carry seals of approval from Government Standards organizations. We trust them. But what happens if a Standard is flawed?

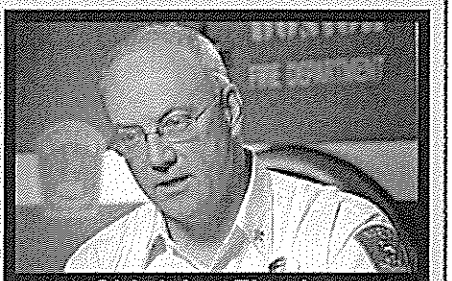
Standards Approved

From 1993-2000 Karl Westwell and Adrian Butler owned and operated a franchise that installed tens of thousands of ionization smoke alarms in Australian and New Zealand homes.

These alarms carried the seals of Standards Australia and in some cases the world's largest testing agency, America's Underwriters Laboratories (UL). So when customers started complaining their smoke alarms would go off when burning toast but failed to activate in real-world fires, Westwell and Butler investigated. What they discovered shocked them.

IAFC Warned about Ionization Alarms in 1980

In September 1980 the International Association of Fire Chiefs (IAFC) published their 'Residential Smoke Alarm Report' urging fire chiefs to only recommend photoelectric alarms.



Chief Jay Fleming
Boston Fire Department
Massachusetts, USA. Dec 2007
UL217 Standards Committee Member

"I think the ionization alarm is responsible for as many as 10,000 deaths since 1990."

Deadly Smoke Detectors TV series:
www.theWFSF.org/cbs

They warned ionization alarms;

"... might be so slow to operate in a smoldering fire that lives may be in danger."

The IAFC also warned about combination ionization/photoelectric alarms; ***"...what is to be gained by adding an ionization element to a good photoelectric element? In the sub-committee's opinion, nothing"*** (Page 6, Appendix B).

UL Testing Questioned

In December 1999 in the Washington Post's exposé, 'How Safe are Products Bearing the UL Mark?' Boston Fire Chief Jay Fleming warned, *"While an alarm may sound in UL's labs, it may not go off in a home..."*.

Share on FaceBook I Find out more:
www.Scribd.com/doc/139524431

'Silent Alarms' Documentary

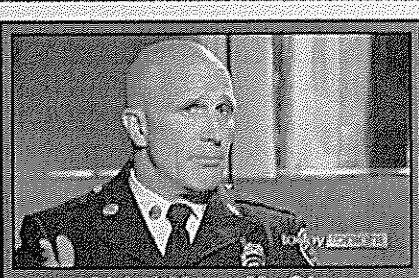
In January 2000 Canadian TV aired an award-winning documentary, 'Silent Alarms'. This film featured a landmark law suit where US$16.3M was awarded in punitive damages because the manufacturer, *"Failed to disclose the known limitations of the (ionization) detector to the consumer"* - even though the manufacturer argued their alarms passed UL's testing standards.

"But we have to rely on the Standards."

Because of the large number of customer complaints and after extensive research, Westwell and Butler co-founded the World Fire Safety Foundation (WFSF) in March 2000. The WFSF's mission is to warn the public and fire fighters about the life-threatening defects inherent in all ionization smoke alarms.

Nevertheless, for six years fire authorities in both the USA and Australia took the position there was nothing wrong with ionization alarms because they passed the Standards.

However, in February 2006, Standards Australia discovered a serious flaw in the Australian Standard. CSIRO data showed ionization alarms were not activating in smoke alarm tests until *"dangerously high and totally unacceptable"* levels of smoke.



Chief Marc McGinn
Albany Fire Department, CA, USA
Today Tonight, Australia. June 2011

"...it's about recall: it's about banning ionization technology and only having the photoelectric technology."

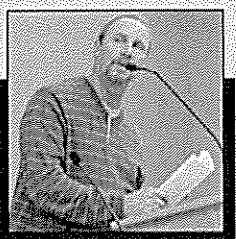
www.theWFSF.org/tourstory2

UL & Kidde (UTC) Try to Block Photoelectric Legislation

"I was appalled when I heard Kidde was going to be here and I was appalled when I heard Underwriters Laboratories was going to be here. They are here for one reason. Profits. They want to protect monetary interest . . . we want to protect your kids."

Dean Dennis, Fathers For Fire Safety, testifying at Albany City Council hearing. June 2010

www.theWFSF.org/afdo



Dean Dennis

When Standards are Flawed - Who Can You Trust?

The Smoke Alarm Manufacturers and Government Agencies who Failed to Warn us for Decades?

OR

The International Association of Fire Fighters?
(over 300,000 US and Canadian members)

- Do not fight fires or risk their lives.
- Despite empirical scientific evidence proving ionization smoke alarms are unable to respond reliably to the presence of visible smoke, they continue to fail to warn the public.[1]
- Recommend Photoelectric AND Ionization alarms.

- Risk their lives fighting fires.
- Urge changing to photoelectric alarms to; ***"drastically reduce the loss of life among citizens and fire fighters."*** The IAFF also warns; ***"Ionization smoke alarms may not operate in time to alert occupants early enough to escape from smoldering fires."***
- Recommend ONLY photoelectric smoke alarms.

"The International Association of Fire Chiefs discovered ionization smoke alarms were dangerously defective in 1980[2]: www.theWFSF.org/iafc *Tragically their message was buried. So after decades of failing to warn the public and after thousands of needless deaths, manufacturers and Government agencies now claim (since 2006) there are two types of fires (smoldering and flaming) so you now need two types of smoke alarms[3].*

This is misleading, there are not two types of fires. There are stages of a fire. Most fires have a smoldering stage that usually transitions into the flaming stage. Ionization alarms are unreliable in the smoldering stage."

Adrian Butler, Chairman, The World Fire Safety Foundation, NSW, Australia, May, 2013

Note: see the IAFF's position above, and the official position of all Australian and New Zealand Fire Brigades (AFAC) on page 1.

[1] See the series of Open Letters where UTC, the world's largest ionization alarm manufacturer has failed to disclose the level of smoke their ionization smoke alarms activate in CSIRO testing to an Australian Member of Parliament: www.SmokeAlarmWarning.org/utc

[2] Most Fire Departments today are unaware of the decades of misinformation about ionization alarms and flawed Government Smoke Alarm Standards. However, as they become aware of the facts, an increasing number of Fire Departments are making a stand, e.g.: North East Ohio Fire Prevention Association: www.NEOFPA.org | Queensland Fire & Rescue Service: www.theWFSF.org/qfrspromo

[3] **Types vs Stages**: Fatal fires often have an extended smoldering stage - before the fire bursts into flames Photoelectric alarms are proven reliable for BOTH stages. Ionization alarms have been proven to be defective in the early, smoldering stage of fire. If you can convince consumers there are two types of fire you can sell them two types of alarms. However, if you have two stages of fire you only need ONE alarm - one that will respond reliably to the early smoldering stage AND the flaming stage. This is why the IAFF only recommend stand-alone photoelectric alarms and do NOT recommend combination photoelectric/ionization alarms: www.theWFSF.org/iaff (see graph on next page).

Why Australian and US Smoke Alarm Standards Can Not be Trusted

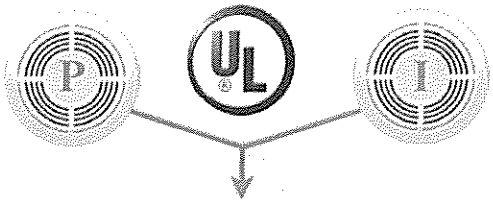
US Smoke Alarm Standard: UL217

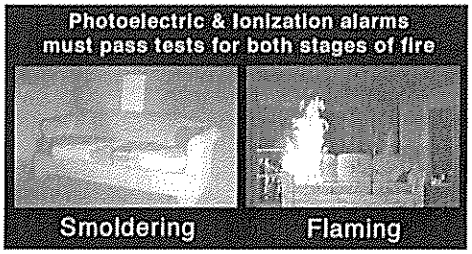
Photoelectric and Ionization alarms must pass identical smoldering and flaming fire tests. . .

Passing Identical Tests
Manufacturers defend their ionization alarms stating, for example, *"Every Kidde smoke alarm, regardless of technology, **must pass identical tests** in order to meet the current smoke alarm performance standard, UL217."*

However, UL is being sued for alleged fraudulent Standards testing:
www.theWFSF.org/ulsued

Tested by

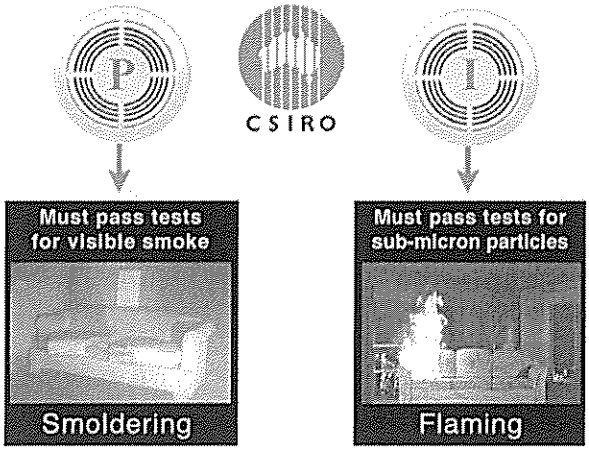




. . .but what if the tests are flawed?

Australian Smoke Alarm Standard: AS3786-1993

Tested by



Photoelectric smoke alarms must pass tests for visible smoke
i.e. smoke particles typically generated in the **early**, smoldering stage of a fire which continue into the flaming stage.

Ionization alarms must pass tests for sub-micron particles, but not visible smoke
i.e. invisible particles are typically generated **after** fire in the early, smoldering stage transitions into the flaming stage.

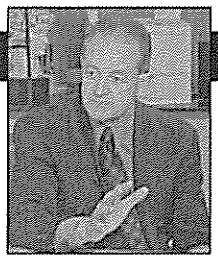
Clause 2.1 of Australia's Smoke Alarm Standard states,
"The smoke alarm shall be designed to respond reliably to the presence of smoke."

In 2005 the WFSF warned the Standard was flawed as ionization alarms were not required to pass the test for visible smoke. Standards Australia corrected the flawed Standard in August 2008.

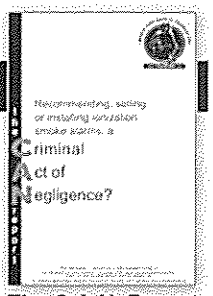
The Australian Building Codes Board is continuing to block the amended Standard: www.theWFSF.org/sa

Flaw in Australian Standard Discovered Feb 2006

"What we discovered to our horror, as the Australian Standard's committee doing some enquiries into test data, was that the ionization smoke alarms are allowed to go to 50-60% (smoke) obscuration per meter, dangerously high, totally unacceptable!"
David Isaac, **Standards Australia Committee FP002 Member**, NSW, Australia.
August 2006 from 'The C.A.N. Report', (page 8) www.theWFSF.org/can



David Isaac



The C.A.N. Report

Dr Megan Clark

The CSIRO advised Standards Australia in February 2006 that photoelectric smoke alarms, when tested by the CSIRO in accordance with the Australian Smoke Alarm Standard, respond to 8-16% smoke (light obscuration per meter). The maximum limit set for photoelectrics under the Standard is 20%. Ionization smoke alarms subjected to the same tests do not respond until over 50% smoke. Examine Standards Australia's argument to require ionization alarms to pass the same test for visible smoke that photoelectric smoke alarms must pass: www.Scribd.com/doc/13917758

CSIRO scientific test data proves ionization alarms do not respond reliably to the presence of smoke. The public needs to know that their ionization alarms may not give the early warning they need to safely escape from smoldering fires. Will the CSIRO's Chief Executive, Dr Megan Clark act responsibly and block certification of ionization alarms before more lives are needlessly lost? (See Open Letter on page 4).

Monday 13 May, 2013

Dr Megan Clark I Chief Executive, CSIRO
C/- Annemaree Lonergan I P.A. to Dr Clark I by Email
Locked Bag 10, Clayton South VIC 3169 I by Registered/Certified Mail

Open Letter Extract: Should the CSIRO Certify Ionization Smoke Alarms?

Dear Dr Clarke

This Open Letter is following the advice of Mr Mark Brisson, the Australasian President of United Technologies Corporation (UTC) the world's largest ionization smoke alarm manufacturer (see final paragraph below).

The World Fire Safety Foundation (WFSF) has been communicating with the CSIRO for several years about litigation and public safety concerns with the CSIRO's testing of ionization smoke alarms.

UTC own the Quell, Chubb and Kidde smoke alarm brands. Standards Australia are responsible for Australia's Smoke Alarm Standard. Testing in accordance with the Standard is conducted by third parties, primarily the CSIRO. On 23 April 2012, at my request, my local MP, Mr Chris Gulaptis, wrote to UTC requesting disclosure of the level of visible smoke the Quell Q946 ionization smoke alarm in his home activated under CSIRO testing. When UTC's President Mr Brisson responded to Mr Gulaptis's letter on 04 June 2012 he failed to answer Mr Gulaptis's sole question. Despite three follow up letters in August and November 2012, and February 2013, UTC have, after a period exceeding one year, failed to answer Mr Gulaptis - hence the reason for this letter.

A Certificate of Conformity for the Quell Q946 ionization smoke alarm in Mr Gulaptis's home was issued under the CSIRO's ActiveFire Verification Services scheme on 22 December 2011 (attached). The Certificate of Conformity and all Gulaptis/Brisson letters are in the Public Domain: www.SmokeAlarmWarning.org/utc

Litigation: CSIRO scientific test results state ionization smoke alarms do not activate until **at least double** the 20% maximum limit for visible smoke set by Standards Australia. In Mercer vs BRK, US$16.7M in punitive damages was awarded when BRK; *"failed to disclose the known limitations of the (ionization) detector to the consumer."* www.theWFSF.org/mercercase In 2008 U.S. Federal court appeal judges ruled that the failure of an ionization alarm to sound a timely warning was; *"a legal cause of the deaths of William and Christine Hackert."* www.theWFSF.org/hackertcase An original hard copy of the WFSF's C.A.N. report 'Recommending selling or installing ionization smoke alarms', a **C**riminal **A**ct of **N**egligence?' was provided to the CSIRO in February 2007: www.theWFSF.org/can

Public Safety: The CSIRO's Code of Conduct states; *"Our primary function is to . . . encourage or facilitate the application and use of the results of CSIRO scientific research."* (page 2, para 2). Note the statement made by UTC's Mr Brisson in his attached letter of 04 June 2012; *"...if you have any questions regarding the Certificate of Conformity issued by the CSIRO Verification Services,* ***these questions should be directed to the CSIRO.***" Ms Clark, further to Mr Brisson's request, please advise the smoke density recorded under the CSIRO's smoke alarm sensitivity testing under clauses 7 (e) and (f) of AS2362.17 for Quell's Q946 ionization smoke alarms as per the CSIRO's Certificate of Conformity.

An objective of the CSIRO ActiveFire scheme is; *"To provide an effective and* ***transparent*** *mechanism for testing..."* www.activfire.gov.au/outline.asp An email copied to you in August 2009 asked (in the interests of transparency), if we could film the CSIRO's smoke alarm testing. The message was unanswered. May we, or the media, film these tests?

Please advise. Thank you.

Sincerely,

The World Fire Safety Foundation
Adrian Butler *Chairman, Co-Founder*

Complete Document in the Public Domain
This Open Letter extract is part of a larger document which includes a CSIRO 'Certificate of Conformity'.
www.Scribd.com/doc/139516400

More: Open Letters to Underwriters Laboratories (UL) about flawed testing of ionization alarms: www.theWFSF.org/ulletters
The law suit alleging fraudulent Standards testing of ionization alarms by UL: www.theWFSF.org/ulsued

The World Fire Safety Foundation
45 The Lakes Boulevard, Wooloweyah, NSW 2464 AUSTRALIA P +61 (0) 409 782 166 E ab@theWFSF.org

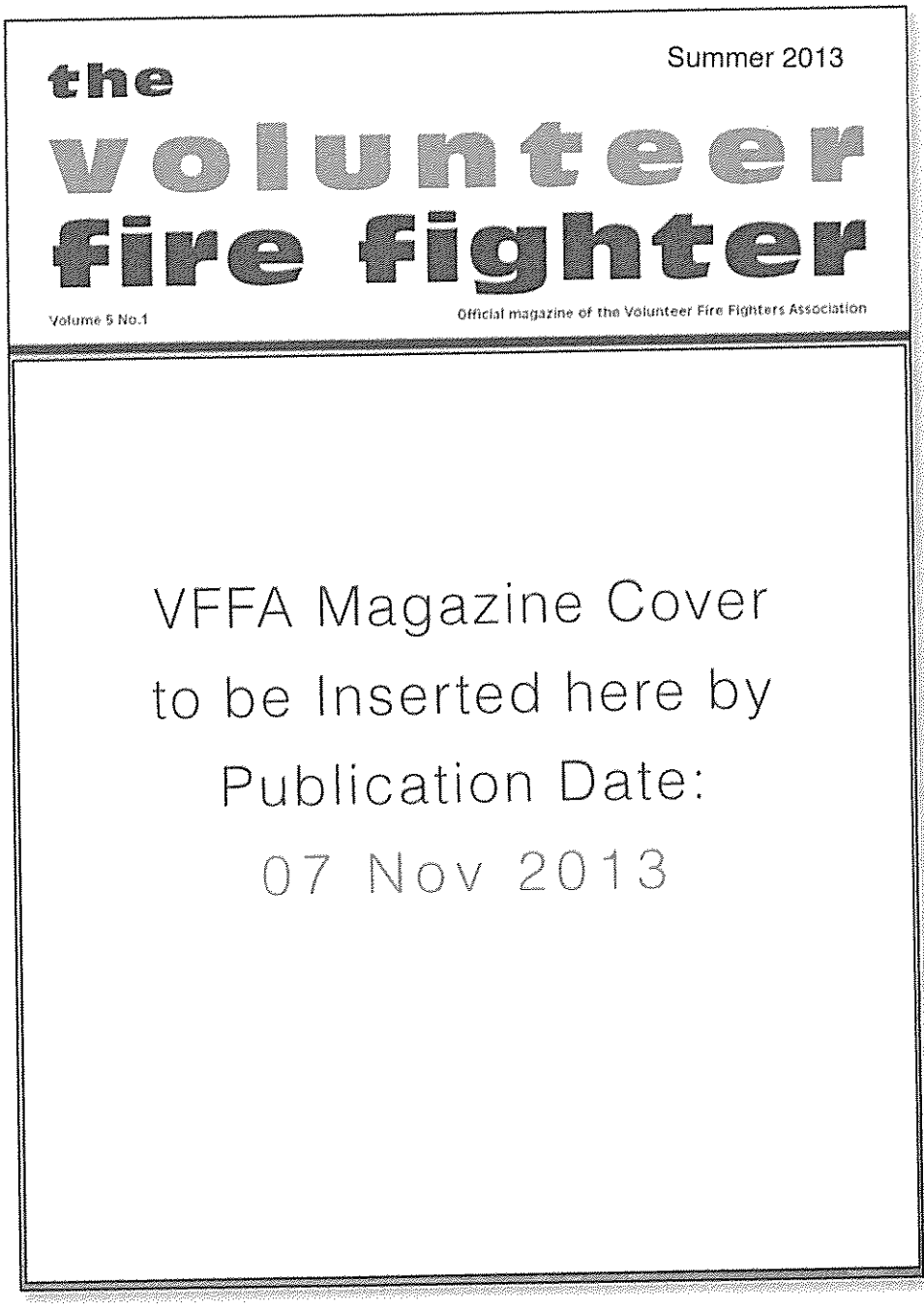
It's time for a solution - to end the double standard and pass legislation to mandate the same photoelectric protection in our homes as in our commercial buildings - before more lives are needlessly lost.

Can Australian and US Smoke Alarm Standards be Trusted?

Part 2 - October, 2013

This World Fire Safety Foundation special report has been extracted from the Summer 2013 edition of Australia's Volunteer Fire Fighter Association's (VFFA) quarterly magazine.

The Foundation thanks the (VFFA) for permission to reproduce this report.



"...science is the commitment to keep searching for reality by empirical means and ***to be willing to discard accepted or long-held positions if our search finds that the truth is different."***

His Holiness The Dalai Lama, The Universe in a Single Atom, Page 25, para 1

Can Australian and US Smoke Alarm Standards be Trusted? Part 2

Full Report with Open Letters:
SmokeAlarmWarning.org/standards.html

Parliamentary Speech I CSIRO Refuses Filming I Ohio Fire Fighters Unite I NY Legislation

There are two completely different *types* of smoke alarms - Ionization and Photoelectric. Both can be battery or hard-wired.
The Ionization *type* are in most homes The Photoelectric *type* are in most commercial buildings.

May 2004: Photoelectric alarms made mandatory in new Australian commercial buildings.

Feb 2006: Discovery that CSIRO scientific test data shows ionization alarms do not activate until *"dangerously high"* levels of smoke.

Jun 2006: Australian & New Zealand Fire Departments stop distributing ionization alarms - strongly recommend photoelectrics.

Sep 2013: Despite requests from a member of the Australian Parliament, the World Fire Safety Foundation and the media, the Australian Government (CSIRO) refuses to allow the media to film their scientific testing of ionization alarms.

Big breakthroughs! I recently moved interstate and made contact with my local newspaper about our smoke alarm campaign. I told them the ionization type of smoke alarm in almost all Australian and US homes has been scientifically proven to be unsafe and people will continue to be needlessly killed until the truth about their inherent defects is finally exposed.

Understandably, the media are skeptical. Journalists often asked, *"If what you are claiming is true, why hasn't this information been made public?"* Good question. However, this time it was different. The journalist, Geoff Helisma asked all the right questions, he researched the story and dug deep.

'Time to Ring the Alarm on Smoke Detectors' is a technically accurate, well written exposé. What has turned the media around? Why have they stopped questioning the World Fire Safety Foundation (WFSF) and started investigating the authorities?

Time to Ring the Alarm
Clarence Valley Review - 18 Sept, 2013


Review
Time to ring the alarm on smoke detectors...

Wooloweyah resident Adrian Butler has dedicated much of his time over the past 13 years highlighting the inadequacies of ionization smoke alarms commonly found in most homes. Despite what appears to be overwhelming evidence in support of his case to make photoelectric alarms mandatory in homes, change is slow to come.

Scribd.com/doc/168984683

Parliamentary Speech

After examining the evidence about ionization alarms, Mr Chris Gulaptis, a member of the Australian Parliament wrote to the manufacturer about the Quell-branded ionization smoke alarm in his own home. He requested the level of smoke his alarm activated under Australia's Smoke Alarm Standard (AS3786-1993). The Quell, Chubb and Kidde brands of smoke alarms are owned by United Technologies Corporation (UTC), the world's largest retailer of fire safety products. Despite five letters to UTC, at the time this report went to press UTC has failed to answer Mr Gulaptis's sole question.

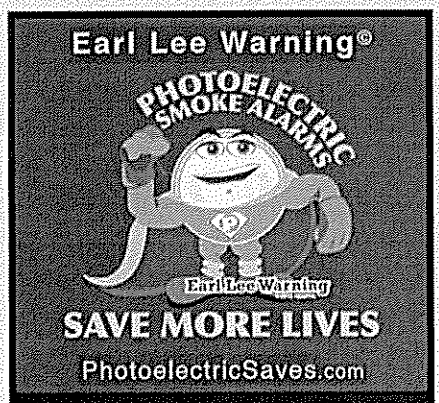
CSIRO Refuses Filming of Smoke Alarm Testing

The Australian Government's Commonwealth Scientific and Industrial Research Organization (CSIRO) is one of the world's largest scientific organizations. After numerous requests by the WFSF and the media to film their testing of smoke alarms in accordance with Australia's Smoke Alarm Standard they finally refused.

David Isaac (see next page) from Australia's Smoke Alarm Standards Committee FP-002 stated:

"It is unconscionable that the CSIRO will not allow the filming of an Australian Standards acceptance test. Confidentiality is an unacceptable excuse because brand identity can be protected. If the tests could be filmed the public would be outraged. They would see for themselves that the ionization alarms do not activate until the CSIRO test room is so full of smoke that the public would consider it dangerous and totally unacceptable."

Ohio Fire Fighters Unite for Photoelectric Alarms



Due to the Ohio State Fire Marshal's failure to accept scientific evidence proving the flaws inherent in ionization smoke alarms, an increasing number of Ohio's fire departments are implementing photoelectric legislation within their own municipalities.

Kidde (UTC) have been promoting their new 'Worry Free' range of smoke alarms throughout Ohio. They are all photoelectric alarms. A Kidde Regional Sales Manager congratulated Cincinnati on their recent photoelectric legislation and urged Fire Chiefs to implement photoelectric legislation in their respective cities across Ohio.

The writing is on the wall for ionization smoke alarms; the only question is, *"How many more will needlessly die before the scientific evidence withheld by UTC and the CSIRO is finally revealed?"*

Vermont Fire Fighter and U.S. Smoke Alarm Standards Committee Member Inspires Australian Parliamentary Speech

In December 2005 Captain Russell Ashe responded to a tragic house fire in Barre City, Vermont. Four children and their Mother died in a home fitted with hard-wired, ionization smoke alarms. This fire was the catalyst for America's first State-wide photoelectric-only legislation which came into force on 01 January, 2009.

After the fire Captain Ashe was awarded a medal of honor and became a member of UL217, the committee overseeing America's Smoke Alarm Standard. In May 2012 he visited Australia to meet with Mr Chris Gulaptis MP and Mr David Isaac. His trip made headlines and inspired the landmark Parliamentary Speech, 'Are Ionization Smoke Alarms Defective?'

Chris Gulaptis MP with Captain Russell Ashe
NSW, Australia May, 2012

'Are Ionization Smoke Alarms Defective?'

Chris Gulaptis MP's Parliamentary Speech, NSW, Australia | 20 June, 2013
Italicized quotes below from speech transcript: SmokeAlarmWarning.org/thespeech.html

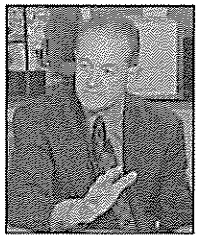
Chris Gulaptis MP
Will the CSIRO allow filming of tests?

Will the Public and Press Allow the Government's (CSIRO) Stonewalling Tactics to Continue while Lives are at Stake?

"Adrian Butler, Chairman of the World Fire Safety Foundation, is one of my constituents. He believes the test data held by the CSIRO and manufacturers is the key to saving thousands of lives around the world every year. David Isaac informed me that photoelectric alarms typically activate at between 8 per cent to 12 per cent smoke in CSIRO tests. At what level of smoke did the Quell-branded United Technologies Corporation ionization smoke alarm in my home activate under CSIRO testing? ***Will the CSIRO allow the media to film its smoke alarm testing?"***

Ionization Smoke Alarms are Dangerous

"Recently I consulted with Mr David Isaac, a committee member overseeing Australia's smoke alarm standard. Sunday's Sun-Herald featured a story titled "Flawed detectors pass the test" and quoted Mr Isaac's statement, "Ionization alarms are dangerous and the public have been misled into believing they are safe."



Mr David Isaac
Australian Standards Committee Member

Mr Dean Dennis
Fathers For Fire Safety, Ohio, USA

Cincinnati, Ohio Legislation Mandates Photoelectric Smoke Alarms

"Last week I spoke with Mr Dean Dennis from Cincinnati, Ohio. Dean lost his daughter Andrea, along with three other students, in a house fire 10 years ago. The house was fitted with ionization smoke alarms. Dean is regarded as a world expert on smoke alarm technology. He travels across the United States of America educating firefighters and senior fire department and government officials. He has been instrumental in numerous cities and States mandating the use of photoelectric smoke alarms. Cincinnati recently enacted legislation mandating photoelectric smoke alarms. Mr Dennis contacted me regarding the necessity of bringing this issue before Parliament."

Can Australian and US Smoke Alarm Standards be Trusted? Part 2

Part 1 (May 2013), and the full version of this report (part 2) with links to the Open Letters to Ohio's Governor, the Australian Government's CSIRO Board and the Parliamentary Speech are at:

SmokeAlarmWarning.org/standards.html

WFSF Testifys at New York City's Photoelectric Smoke Alarm Legislation Hearing

On the 24th of October, 2013 the World Fire Safety Foundation's video and written testimony was presented at the New York City Council's (NYCC) smoke alarm legislation hearing.

The NYCC's proposed legislation requires the installation of photoelectric smoke alarms in residential buildings in the city of New York. Information about New York City's legislation and 'Averyana's Law', the proposed state-wide legislation is here:

SmokeAlarmWarning.org/ny.html

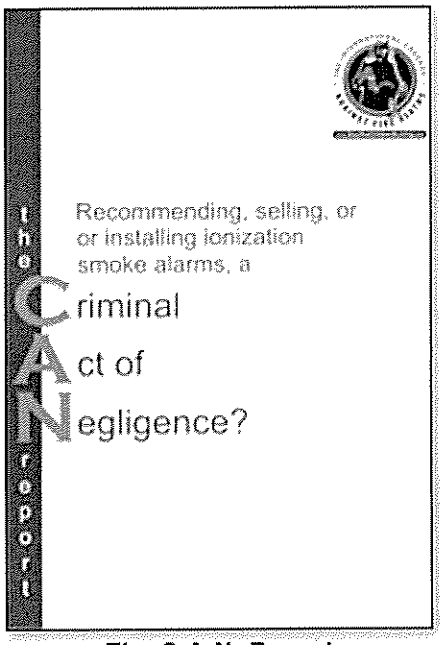
WFSF Video Testimony to the New York City Council

More . . .

These documents and films and more are available on the world's largest resource exposing flawed Smoke Alarm Standards:
www.WorldFireSafetyFoundation.org

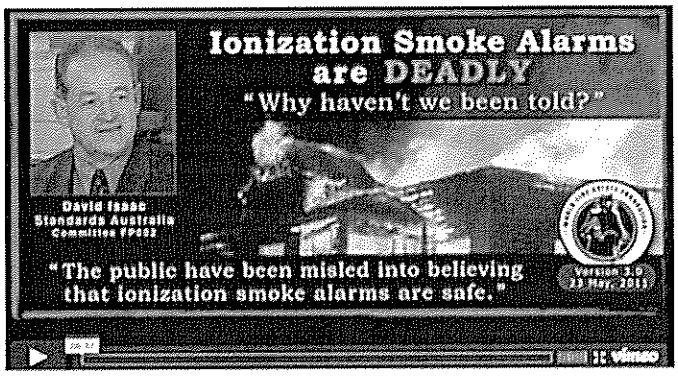
The CAN Report (Feb, 2007) warned of flawed smoke alarm research, dating back to 1976, which has been relied upon by fire authorities in the formulation of global smoke alarm standards.

It reveals legal precedence where punitive damages have been awarded for failure to disclose the known limitations of ionization smoke alarms to consumers:
www.theWFSF.org/can



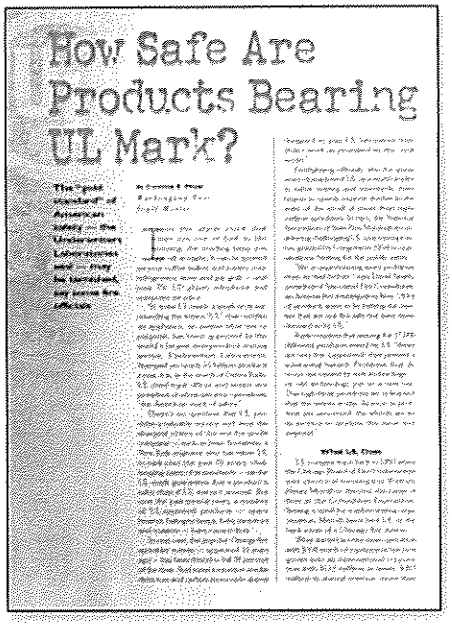
The C.A.N. Report

Film: Ionization Smoke Alarms are DEADLY



Film: Ionization Smoke Alarms are DEADLY
Australia's flawed Smoke Alarm Standard:
www.theWFSF.org

How Safe are Products Bearing the UL Mark?



Washington Post Exposé about UL's Smoke Alarm Standard (UL217):
www.theWFSF.org/ul2

Film: UL-Approved Smoke Alarms May Give False Sense of Security

Why does UL put their 'seal of approval' on smoke alarms that often remain silent in a room full of smoke?
www.theWFSF.org/ul

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

☒ in favor ☒ in opposition 865

1111

Date: 10/24/13

(PLEASE PRINT)

Name: JOHN CAULFIELD

Address: 296 YARMOUTH RD, ROCHESTER NY

I represent: NATIONAL FIRE PROTECTION ASSN

Address: 1 BATTERYMARCH PK, QUINCY MASS

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. _____ Res. No. _____

☐ in favor ☐ in opposition

Date: _____

(PLEASE PRINT)

Name: Donald Roushe

Address: Dept of Buildings

I represent: 280 Broadway

Address: Director of Intergovernmental Affairs

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on ~~Int. No.~~ ~~X~~ ~~/~~ ~~Res. No.~~ 865 opp

☐ ~~in favor~~ ☑ in opposition 1111 fav

FDNY

Date: 10.24.13

(PLEASE PRINT)

Name: Tom Jensen

Address: Chief in Charge of

I represent: FDNY Fire Prevention

Address:

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. 865 Res. No. _____

☒ in favor ☐ in opposition

Date: _____

(PLEASE PRINT)

Name: Roland "Skip" Walker

Address: 8001 Sneath Ln. Cambria CA

I represent: ASHI & CREA

Address: _____

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. 0865 Res. No. _____

☒ in favor ☐ in opposition

Date: _____

(PLEASE PRINT)

Name: Dean Dennis

Address: 8139 Oakbrook

I represent: Myself

Address: 8139 Oakbrook Ct, Cin'ti, Oh

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. 0865 Res. No. _____

☒ in favor ☐ in opposition

Date: 10.24.13

(PLEASE PRINT)

Name: Russell Ashe

Address: 287 Tripp Road Williamstown, VT 05679

I represent: Myself

Address: same as above

Please complete this card and return to the Sergeant-at-Arms

THE COUNCIL
THE CITY OF NEW YORK

Appearance Card

I intend to appear and speak on Int. No. 1111 Res. No. _____

☐ in favor ☐ in opposition

Date: 10/24/13

(PLEASE PRINT)

Name: Frank Ricci

Address: _____

I represent: Rent Stabilization Assoc.

Address: _____

Please complete this card and return to the Sergeant-at-Arms