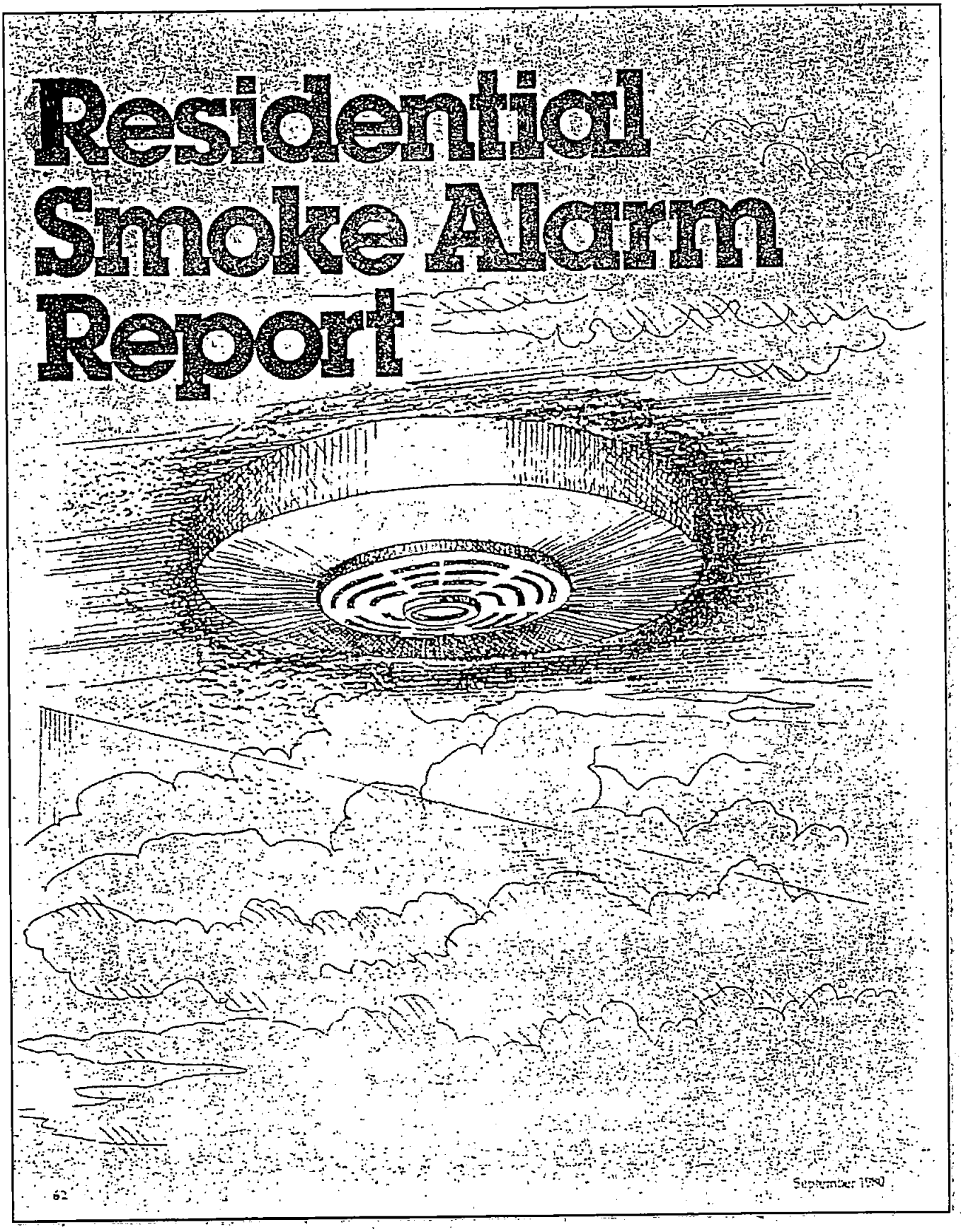
Residential Smoke Alarm Report



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SMOKE ALARM/DETECTOR MATERIAL

Ionization vs. Photoelectric

1) 1980 IAFC Residential Smoke Alarm Report

2) Gentex Corporation Smoke Alarm/Detector Research Comparison

3) University of Cincinnati 2010 Smoke Alarm Symposium Notes

4) University of Cincinnati 2010 – Father's for Fire Safety Presentation

5) Fire Life Safety Consulting – Boston FD Chief Jay Fleming

6) Senator John Kerry's letter to the Consumer Product Safety Commission

7) Combination Smoke Alarms: A Dangerous Compromise

8) The Defect in Smoke Alarms: by TMZ Lawyers

9) Richard Patton – Original Committee Chairman of NFPA 74

10) Additional reading produced by; The World Fire Safety Foundation

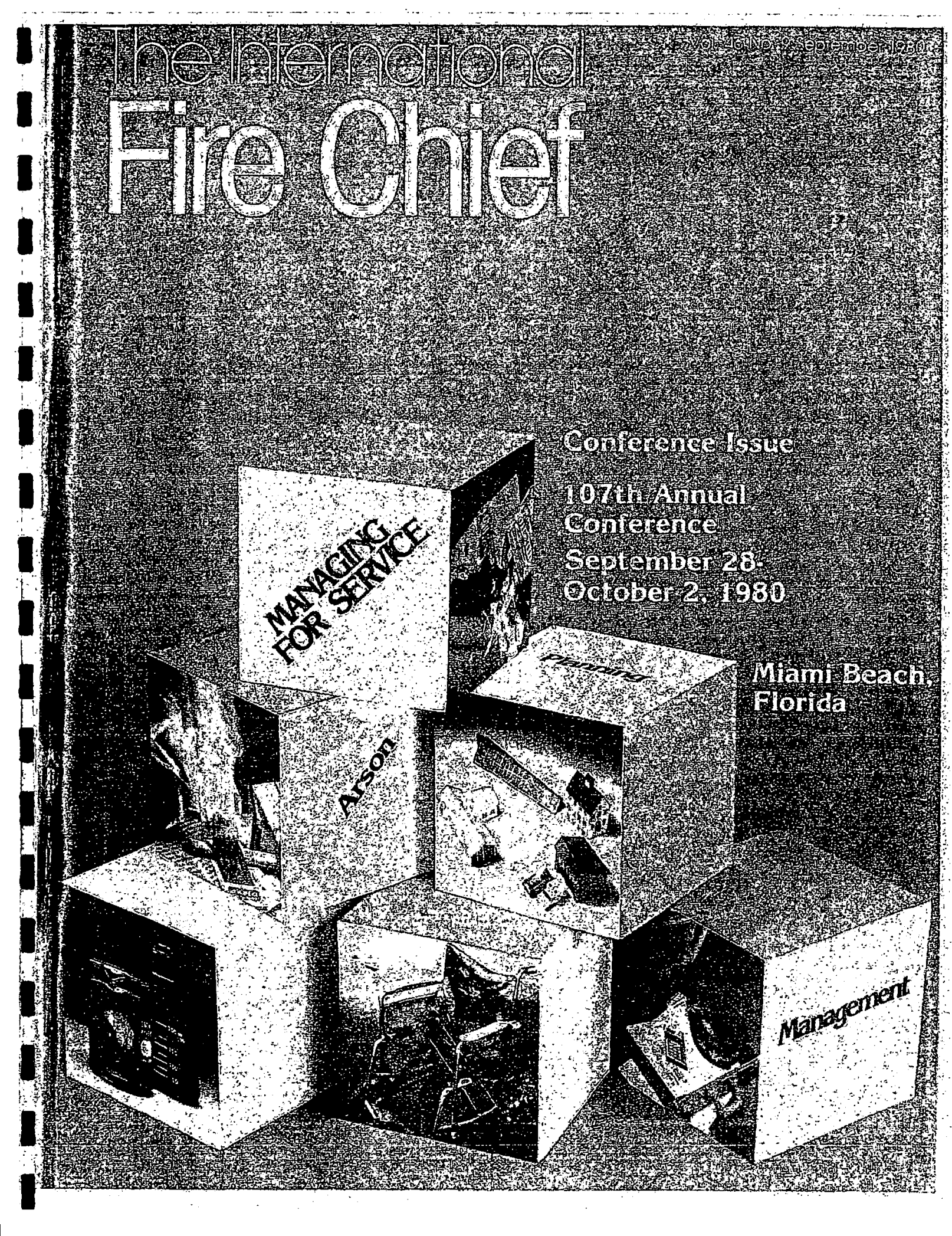
The 1980 International Association of Fire Chiefs

RESIDENTIAL SMOKE ALARM REPORT

Concentrate beginning with The Fire Chief's Recommendation and read to Appendix B. You will be shocked to realize we are fighting the same issues today. Some experts (photoelectric advocates) believe there are 30,000-50,000 people in graves today that should never have been... if we only employed what was written in this document 30 years ago. Let's not forget, for every fire death, there are five who are disfigured for life. You hold the key to change and this recommendation you are about to read is the greatest life safety change you will ever make in your entire career... if you make this change.

Vol. 46 No. 7 September 1980

The International Fire Chief



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Vol. 46 No. 9 September 1980

The International Fire Chief

Features

Departments

The International Fire Chief is the official publication of the International Association of Fire Chiefs. The magazine's purpose is to provide information and a forum for the exchange of information which would be of assistance to those charged with administering fire prevention, protection and suppression efforts. The opinions expressed in the magazine are those of the individual authors and do not necessarily represent the official position of the Association. Third Class postage paid at Riverdale, Maryland. The International Association of Fire Chiefs, organized in 1873, is dedicated to the advancement of the fire service. It continually surveys and analyzes fire problems for the benefit of its members.

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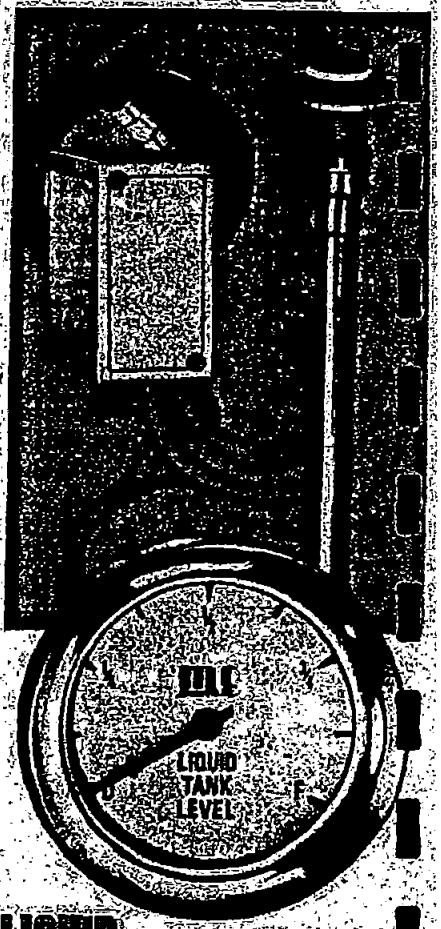
THE PUMPER PLEASER



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Prepared by a Special Subcommittee of the Automatic Detection Committee of the International Association of Fire Chiefs

Over the past several years, there has been an ever-increasing number of smoke alarms advertised, purchased and installed in single family dwellings. In many instances, fire and building codes have set requirements for such installations.

The interest in personal and family fire protection is probably at an all-time high. As a consequence, citizens are turning to their fire departments for information. This presents a fine opportunity for excellent communication and understanding between the fire department and the public, but it also presents a challenge that is not without problem.

Fire service personnel, under the direction of the fire chief, are being asked which detector to buy, how many detectors should be bought, where should they be installed, and should an ionization, photoelectric, gas or heat detector be purchased? The public expects the fire department to be able to answer those questions intelligently, and it intends to rely on those recommendations.

One way or another, fire service leaders are expected to see that reliable answers to these questions are provided. Unfortunately, too many fire departments, including some seemingly progressive departments, are not in position to give good answers based on solid information.

Recognizing this, a policy statement (see the August 1977 issue of this magazine, page 14) was passed by the board of directors and the membership of the International Association of Fire Chiefs (IAFC) in 1977. This statement outlined a suggested position which would allow fire chiefs to fulfill their responsibilities to their constituencies, yet protect their departments and themselves. The statement also indicated action to be taken by the Automatic Detection Committee to help the fire chief become better able to serve the public in this important area.

Furthermore, the committee was ordered by the president of the IAFC (Chief John Swindle at the time) to test, evaluate and distribute, at the earliest possible moment, information pertaining to automatic fire detection equipment, including those areas where promotion and advertising is misleading the fire chief and the public.

This report is the first of several steps being taken to fulfill that presidential mandate. It has been prepared by a special subcommittee of the IAFC Automatic Fire Detection Committee.

Some Basic Thoughts About Automatic Fire Alarms

It must be recognized that people are poor fire detectors if they are not awake. It is a well-established fact that the vast majority of fatal fires occur during the hours when people are asleep. The victims usually die because they are not aware of the fire in time to escape its deadly by-products, namely smoke, heat and toxic gases. Automatic fire detection and early warning equipment (simply called a fire alarm) alert the sleeping occupants to the fire *in enough time so that people can take proper escape actions.* Fire alarms are successful when they give enough time to escape and are followed by proper evacuation procedures.

While that statement seems axiomatic, it is important to understand that some types of devices or equipment, because of either their nature or their installation, activate long after the fire has started. In such cases, the warning may not allow enough time for the occupants to escape.

The ability to escape from a fire is related to the tenability of the escape routes. Such tenability traditionally is measured in terms of the quantity of smoke and heat present in the area of escape, and the toxic content of the air. Based upon School Burning #2 (tests conducted by the City of Los Angeles in the late 1950's), a smoke density obscuration (a means of measuring smoke by the obscuration of a light beam) of 4% has been considered the maximum limit for successful activation of smoke detection devices. Generally, it takes temperatures of more than 135°F to activate heat-detecting devices in normal environments. Tests indicate toxic gas buildup generally follows these detectable limits of heat or smoke. Therefore, activation of fire alarms from these amounts of smoke

Subcommittee Members

The members of the Special Smoke Detector Subcommittee are:

- Thomas C. Hayden, Chairman, Deputy Chief, Lower Merion Fire Department, Ardmore, Pennsylvania;
- John T. Brennan, Chief, Bayonne Fire Department, Bayonne, New Jersey;
- James Dalton, Assistant Chief, Montgomery County Fire and Rescue Services, Rockville, Maryland; and
- John C. Gerard, Chief Engineer and General Manager, Los Angeles City Fire Department, Los Angeles, California.

or heat, allowing ample time to put escape routes into practice, would be considered successful (refer to Appendix A).

It is important to note that, when one measures tenability in terms of heat and smoke, in real life fires it is possible to have a fire that starts as a very slow, smoldering fire (a cigarette on a mattress) which produces copious amounts of smoke before there is a significant temperature rise. The time interval may be as long as a couple of hours. However, it is unlikely that a fire producing heat (a flaming fire such as a match in a waste basket) also would not produce measurable amounts of smoke.

To understand which fire detection equipment will provide the most certain degree of successful operation, it is necessary to understand two elements of fire alarm installation, namely a systems approach versus single station units, and detection technique.

What is an Automatic Fire Detection System?

An automatic fire detection system is a variety of elements joined to detect the fire automatically and sound an early warning. Generally, it consists of a central control panel (in the case of an electrical system, this control panel would allow operation on regular household current and should provide emergency backup power to protect against a power failure). It also allows supervision of the circuits (a method of checking itself out, and providing some warning should a trouble situation arise) to ensure that all elements are working properly. Interconnected to the control panel are a series of detection devices (types to be discussed later). When these devices detect a fire, the sounding devices are activated through the control panel to provide early warning in the sleeping and other occupied areas regardless of where the fire originates. It is obvious that the closer to the point of origin a fire is detected, without allowing extra time for the products of combustion to travel to a distant detector, the greater the available escape time.

The advantages of a proper automatic fire warning system include that extra escape time and the sounding of an alarm in the sleeping and other occupied areas regardless of where the fire originates. This can include an audible device outside the home or connected to a fire department or central alarm station to bring help more quickly. This is especially important where children, the elderly, handicapped or those under the influence of alcohol, drugs or medication are concerned.

What is a Single Station Unit?

A single station unit contains a detection element, a power source and a sounding device. Smoke alarms (either ionization or photoelectric) can be battery-operated or operated from household current. (To the subcommittee's knowledge, only two dual-power source single station smoke detectors are available as of this writing, a fact which this subcommittee feels is unfortunate because dual-power obviously provides the greatest guarantee of uninterrupted power.) Single station, heat-activated devices are usually either windup, spring-loaded or powered by an inert gas.

A single station unit sometimes is referred to as a self-contained unit. It is obvious that a single station unit is designed to detect a fire within its area of coverage and sound an alarm *in that same area*. This, of course, highlights one of the weaknesses of a single station unit, audibility. If such a unit is located in the basement of a home and the doors are closed between it and the sleeping area, can it be heard? In the case of practically all the smoke alarms on the market, the answer is probably no. (Refer to Appendix A)

The advantage of a single station detector is cost. Since the unit is self-contained, it is possible to install one device which can cost anywhere from $9.99 to more than $100.

Because of the spot protection offered by the single station unit, some people are installing multiple detectors. While this may be called a system by some, it is not a system because it is not interconnected. However, because of the poor audibility of many single station devices, many now are capable of being interconnected so that when one sounds, all the alarms in a residence are activated. This does approach the system concept, but it has several major differences. One, it is not supervised, so that if one of the detectors involved in either detecting or sounding is not working, or if the wiring between the detectors is broken, no one will be aware of the trouble conditions. Two, no method of sounding outside alarms or connection to a fire department is available, nor is any special equipment for the handicapped.

There is a line carrier connected system of single station units designed to detect a fire in one home and sound a system in a neighboring home. However, this system also is not supervised and will work only if both homes are operating on the same power line transformer. Additionally, the system is subject to false activation by stray electrical current.

Before discussing the pros and cons of a system versus single station units, it is necessary to describe the major categories of detecting elements. For the purposes of household protection, heat and smoke detectors are the two major categories of detector types.

Heat Detectors

A heat detector will activate when the temperature within the area of its coverage becomes abnormally higher. Heat detectors bear an Underwriters Laboratories or Factory Mutual label indicating a recommended tested coverage called the listed coverage, e.g., 30x30 feet or 900 square feet, or 50x50 feet or 2500 square feet. In addition, heat detectors bear the Underwriters Laboratories or Factory Mutual label showing the temperature at which the detector is designed to activate, e.g. 135°F or 195°F where the ambient temperature is higher.

There are two generic types of heat detectors. The first is the spot type (usually electrical), designed to be wired into a system. The second is a detector, usually self-contained and powered by either inert gas or a spring. Heat detectors activate according to type. These are:

- Fixed temperature. . .designed to activate when the temperature in the area of coverage reaches a certain point, i.e., 135°F. It may be a thermal couple or fusible link type in which the temperature melts a specially designed connection.
- Rate of rise. . .this consists of a bellows which reacts to abnormally changing air pressure. It is designed to detect a very rapid rise in temperature, usually 15° in a minute.
- Combination fixed temperature and rate of rise. . .this is self-explanatory and works on both of the above principles. One caution — in a

combination detector, the fixed temperature portion usually does not have the same listed coverage as the rate of rise portion.

Heat detectors obviously will not react to the slow, smoldering, smoky buildup of a fire, but will react when the combustion reaches a point of rapid heat buildup. Therefore, heat detectors should be used only to supplement primary smoke detector coverage in such areas as closets, garages and attics.

Photoelectric Smoke Detector

A photoelectric smoke detector activates when visible smoke from a fire enters the detector. It is sensitive to a smoldering fire as well as the smoke generated by an open flame fire.

Ionization Detector

An ionization detector activates in response to invisible particles created by combusion. It is sensitive to an open flame fire. Contrary to some advertisements, tests conducted by various fire departments and other organizations indicate that this detector does not respond quickly to smoldering fires, often not until smoke within the area builds up to a substantial density which may interfere with escape.

Combination Photoelectric/ Ionization Detector

This detector, as the name implies, uses both an ionization and photoelectric element.

Combustible Gas Detector

Commonly referred to as a Taguchi gas sensor (TGS) and advertised as a gas and smoke detector, this device can detect such combustible gases as methane and propane. It has proven unreliable as a fire or smoke detector, so has been removed from such classification by the National Fire Protection Association and recognized testing laboratories.

Which Detector Should be Recommended?

If experienced fire chiefs knew where and how a fire was going to start, they would be in perfect position to answer this question. Unfortunately, there is no easy answer. Thus, fire chiefs must recommend that citizens have the best protection possible.

What is the Best Protection?

The best protection is a complete automatic detection system consisting of various types of detectors throughout the building. It should consist primarily of multiple smoke detectors augmented by reliable heat detectors. The primary smoke detectors should be located in hallways, bedrooms, stairways, living rooms and other occupied areas. A smoke detector or heat detector then should be placed in every other room of the house, including closets, attics, kitchens, garages and basements. *Each and every room!* Anything less is not complete protection and fire chiefs must recommend complete protection. (Refer to Appendix A)

The subcommittee firmly believes that fire chiefs, as responsible, knowledgeable public safety officials, must recommend complete protection. What other choice do they have?

Because of inherent design problems, such as a tendency to sound false alarms, some manufacturers of smoke detectors provide, in their installation instructions, a caution not to install their smoke detectors in kitchens, attics, boiler rooms or garages. There is a caution against installing smoke detectors in areas where temperatures go below 40°F or above 100°F.

This subcommittee has no objection to installing photoelectric smoke detectors in kitchens because they are not likely to activate from normal cooking smoke or self-cleaning ovens. However, if it is found that a photoelectric detector is sensitive to certain cooking smoke, replace it with a heat detector. Many serious fires originate in kitchens and the area should be protected properly. (Refer to Appendix C)

The subcommittee believes the fire chief should recommend further that the system consist of interconnected components and be supervised by either an Underwriters Laboratories — or Factory Mutual-approved control panel equipped with a rechargeable battery to take over in case of a power failure. In addition, the bells or horns must be loud enough to be heard throughout the building above all other normal noises.

The wiring in the system should be supervised electrically, so that a trouble signal will be sounded for any malfunction in the system.

The system described above is not really expensive, particularly because it is an investment in the best life safety protection a family can provide when combined with an emergency escape plan. A good, properly installed automatic fire and smoke detection system compares in price to a color television. The fire chief should remind citizens that if they are willing to spend a substantial amount for a color television, it is a wise investment to protect the lives of the family against the hazard of the television and all the other appliances and fire threats in a home.

What is the Least Protection?

The least protection is one detector located in an area of the building where the fire is going to start. While this is not very practical, it is an answer to the question. It is almost the same as saying that one sprinkler head will protect a 25,000 square foot supermarket if it is put in the right place.

Is There a Middle Ground For Protection?

If a fire department could not buy the most expensive aerial ladder, it obviously would not settle for a step-ladder and a bicycle. It would seek an apparatus somewhere in between.

Good automatic fire protection should be considered in a similar manner.

Start with the best and most desirable, a complete system, and *slowly and intelligently* let the citizen remove detectors and related equipment in the least likely areas of fire origin until the affordable level of investment is reached. This is not easy, but by proceeding in this manner, when the citizens remove detectors, they then are aware that they are removing protection right up to the point where they bring their detection down to one smoke detector. Then the citizens should know, without a shadow of a doubt, that they have the least protection that money can buy. *There is nothing less!* Then let them be aware that if they install the single smoke detector in the hallway outside their bedroom, close the door and go to bed, they have virtually no protection if the fire starts in their bedroom.

But, remind the citizens that if they choose the minimum amount

of protection now, they can add to the protection next month and the following month and the month after that, until they have raised the level of protection to meet their financial ability and desired level of protection. However, it probably would make better sense to invest in a system initially.

It is important for the fire chief to recommend that people who have extra dollars invest them in complete protection. Fire chiefs should not let those precious dollars be wasted on clever marketing gimmicks that seem attractive, but, in reality, provide little or no protection.

What Should a Smoke Detector Do?

The NFPA's Standard #74, *Household Fire Warning Equipment*, specifies installation and technical requirements. Among other items, it requires that smoke detectors respond before smoke obscuration reaches four percent per foot.

The validity of this standard has been reaffirmed in numerous tests attended and/or conducted by members of the International Association of Fire Chiefs, even though Underwriters Laboratories now lists detectors that will respond to smoke obscuration levels of seven percent. However, how can one tell if a detector complies with NFPA #74? This sounds easy, but it is not, since the fire service is told continually that a UL label identifies the "good" detectors. Surprisingly enough, at present, Underwriters Laboratories only tests detectors under scientifically repeatable laboratory conditions which do not necessarily indicate how the detector performs under actual fire conditions.

So, there are two standards — NFPA's #74 requiring detectors to react to four percent or less smoke obscuration, and a UL standard listing detectors at seven percent smoke obscuration. What are the conditions in a building at four percent and seven percent? This is similar to asking what gasoline smells like. There is no easy answer. The only answer to the four percent and seven percent question is that it is not very pleasant at four percent, and seven percent is even less pleasant. There is also a lack of visibility apparent at this level. In the subcommittee's opinion, this could lead to panic conditions, especially when one wakes up from a sound sleep.

The subcommittee urges the NFPA to continue requiring the four percent level and urges Underwriters Laboratories to reconsider the present seven percent listing and return to its original four percent requirement.

At the same time, the subcommittee is attempting to find a way to require the manufacturer of the device to mark, on the detector and on the advertising, the percentages at which the detector will activate from both an open flame fire and a smoldering fire. In this way, the citizens and the fire chiefs will know what to expect from the detector. The subcommittee asks nothing more than the same kind of requirements presently applicable to heat detectors.

Advertising

The subcommittee is concerned with some smoke detector advertisements. The subcommittee felt that some advertising claims were too strong and, in some cases, deceptive and misleading to the public, resulting in a false sense of security. The subcommittee refers specifically to those advertisements which imply that, in all cases, a single smoke detector will be sufficient to save everybody when a fire breaks out, or those advertisements which state that certain detectors will react before there is visible smoke, heat or flame, when, in reality, these detectors might be extremely slow to activate in a smoldering fire. In fact, they might be so slow to activate in a smoldering fire that lives may be in danger.

The Fire Chief's Recommendation

What kind of detector should the fire chief recommend — ionization or photoelectric? The answer to this question, in the subcommittee's opinion, is clear. However, before this question is answered, it is necessary to discuss test data and information.

Tests and demonstrations conducted by federal agencies, fire departments, manufacturers and consumer organizations have resulted in conflicting answers. Some of the answers indicate that ionization is more effective; some state the photoelectric is more effective; some state you need a combination of both detectors; and some state you get equal protection with either. These contradictory results have confused both the citizen and the fire chief.

The subcommittee has investigated several laboratory tests and the operation of various types of detectors under actual fire conditions. The test results have conflicted, primarily because the results of tests conducted in laboratory conditions and actual fire conditions did not seem to match. And, although UL lists detectors that meet its test procedure, there are many detectors that do not produce the expected results under actual fire conditions.

The subcommittee is aware of many detectors being sold today that will not meet the requirements of the NFPA or the recommendations of the IAFC Automatic Detection Committee when they are subjected to actual smoke conditions from a slow-burning, smoldering fire. But, the detectors will meet the requirements when they are subjected to smoke from an open flame. It is the subcommittee's belief that only the photoelectric detector will meet the requirements reliably when subjected to both open flame and smoldering fires.

The subcommittee believes this has been proven time after time throughout the country in actual tests conducted by manufacturers and fire departments (see Appendix A).

Hard to believe? It certainly is.

Skeptical fire chiefs can verify this belief with minimum effort and time. Locate a typical, vacant, two- or three-story house and install various types of automatic smoke detectors in the second floor hallway as advertisements advise. Then go down to the first floor, throw a cigarette on a couch and stand by to see what happens. See what the conditions are when the alarms activate, *but do not hurry the fire with a match; do not open and close doors; keep the conditions stagnant as they would be in the middle of the night with everyone sleeping; and, above all, do not hurry the fire with a match or a charcoal lighter rod. Let the fire take its natural course. Again and again, do not rush the fire! In an hour or two, a world of information will be gained.*

This test will show that most photoelectric detectors, operated by battery, will detect the smoke at about one and one-half to three percent smoke obscuration, which is good. The test will show that the photoelectric detectors, operated by

household current, will activate between two and four percent, which is still good. But, the test also will show that many ionization detectors will not activate until the smoke obscuration reaches 10, 15, 16, 17, 20 and sometimes 25%.

If a smoke obscuration meter is not available, use experience and background in smoke conditions and give the results a good subjective opinion. Again, this is hard to believe, and is adverse to some advertising and some national tests, but try it.

As a result of these tests, and despite the fact that they are in conflict with federal government tests, consumer testing facilities, fire chiefs, fire fighters, manufacturers and advertisements, the subcommittee maintains that most ionization detectors will not respond quickly to a slow, smoldering fire under actual residential fire conditions.

Therefore, because of the present state of the art in detecting smoke, the Subcommittee on Smoke Detection can take no other course but to recommend the installation of photoelectric detectors. The subcommittee makes this recommendation because most home fires start from a smoldering source, and because the photoelectric detectors are sensitive to open flame fires as well as smoldering flames. (Refer to Appendix B)

A Final Thought

The subcommittee is aware of the fact that carbon monoxide increases rapidly with the buildup of heat. This has been confirmed by the recently completed fire tests in Los Angeles.

With this in mind, it is imperative that smoke be detected and a fire warning given at the earliest possible time before there is a substantial heat buildup.

Further, to be consistent with NFPA Standard #74, the subcommittee feels it is imperative to detect smoke as early as possible, and so concurs with the NFPA's four percent or less smoke obscuration level.

Appendix A

Since the formulation of this report, the results of a series of fire tests held in California have been published. These tests deserve some comment by the subcommittee.

While it is gratifying that the IAFC Automatic Fire Detection Committee was instrumental in starting these tests, and the IAFC Foundation was a substantial source of funding, the major credit belongs to the Los Angeles City Fire Department, under Chief Engineer John C. Gerard (a member of the IAFC and this subcommittee), who was responsible for the actual conduct of these tests with the sponsorship of the California Fire Chiefs Association.

The subcommittee recommends study of these tests to the serious students of automatic fire detection. Simply stated, the series of tests was conducted in homes about to be demolished after condemnation by the Los Angeles Airport Authority. The homes were furnished fully and the tests were conducted in a realistic manner.

The tests were instrumented and produced test data that will take years of further analysis before producing all possible information. However, essentially the tests and their conclusions are applicable to the needs of fire chiefs. The subcommittee particularly points to the fact that the conclusions reached by the Los Angeles tests coincide with the recommendations of this subcommittee report. Namely:

1. A full system of multiple photoelectric smoke detectors, supported by heat detectors, affords the best protection for a family against the threat of fire.

2. Aside from the question of detection techniques and capabilities, a sampling of single station units showed their audibility to be poor enough to negate their widespread use in most residences unless interconnected. Once more, this proves the necessity of a systems approach.

Appendix B

What about the use of a combination photoelectric/ionization detector?

Some new devices are being offered which reportedly combine the detecting techniques of both types. Taken at first glance, this would seem to be an obvious answer to the "which is best" question. The subcommittee does not think it is such an obvious answer and does not think the combination detector is best, for a number of reasons.

First, when compared to ionization detectors, a photoelectric detector will detect flaming fires in an acceptable manner, and in a superior manner in smoldering fires. Therefore, what is to be gained by adding an ionization element to a good photoelectric element? In the subcommittee's opinion, nothing. In fact, the subcommittee believes there are at least two disadvantages:

1. Cost. . .why add anything that will not improve the performance;

2. False alarm potential. . .while this report touches very lightly on the false alarm question, it has been established that the ionization detector has a considerably higher potential for false alarms. It does not make sense to add that disadvantage to an already sufficient photoelectric detector.

Appendix C

It is the responsibility of the supplier or installing contractor to provide the owner with instruction charts describing the operation, method and frequency of testing, and proper maintenance of household fire warning equipment. Periodic inspection, testing and maintenance, however, are the responsibility of the occupant and its importance cannot be overemphasized.

Tests and inspections of other than battery-operated detectors should be made at least once a month. Battery-operated detectors should be inspected and tested once a week. It should be understood that the test button on most detectors simply tests the alarm function, and is not an indication of whether the detector will activate in a smoke condition. Simply stated, the only absolutely positive test is the presence of actual smoke.

Dust, cobwebs and other foreign materials which might cling to the detector and possibly inhibit its efficiency can be removed by either blowing air through the detector or by light vacuuming. No interior cleaning or maintenance should be required except for the normal periodic changing of batteries in battery-powered units.

Generally, if one follows the instructions supplied by the supplier or installing contractor, units should provide reliable protection indefinitely. However, as stated above, regular testing and maintenance on a continual basis is an absolute must.

GENTEX CORPORATION

Presents

Photoelectric and Ionization Smoke Alarms/Detectors

Gentex manufactures only photoelectric smoke detectors that can be found in many schools, dormitories, hotels and hospitals throughout North America. Gentex does not manufacture any ionization type of detectors as they state they are inferior and deadly.

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1 Ionization and Photoelectric Detector Technology

2 Nuisance Alarms

3 Agglomeration and Aged Smoke

4 Results Of Studies On Detector Response

5 Summary

Ionization and Photoelectric Detector Technology

GENTEX CORPORATION

Smoke Alarm Technologies

There are two common types of single station smoke alarms: Photoelectric and Ionization.

- Ionization smoke alarms utilize a small amount of radioactive material to ionize the air in the smoke alarms chamber. This type of technology makes ionization smoke alarms more sensitive to small black smoke particles or even invisible particles of smoke which are typical in fast flaming fires as well as sources such as cooking by-products.
- A photoelectric smoke alarm uses reflected light to sense the presence of smoke. Because of this, photoelectric smoke alarms are more sensitive to the larger gray smoke particles typically produced by slow smoldering type fires, which are the type commonly found to cause more deaths in sleeping room applications.

GENTEX ONLY MANUFACTURES PHOTOELECTRIC SMOKE ALARMS!

Ionization Principle

- A small amount of radioactive material "ionizes" the air in the detector's chamber.
  - Enables the air in the chamber to conduct a small amount of electrical current.
  - Smoke particles attach themselves to the ions, and reduce the electrical current flow.
  - An alarm occurs when the electrical current flow is reduced below a preset threshold.

Ionization Principle

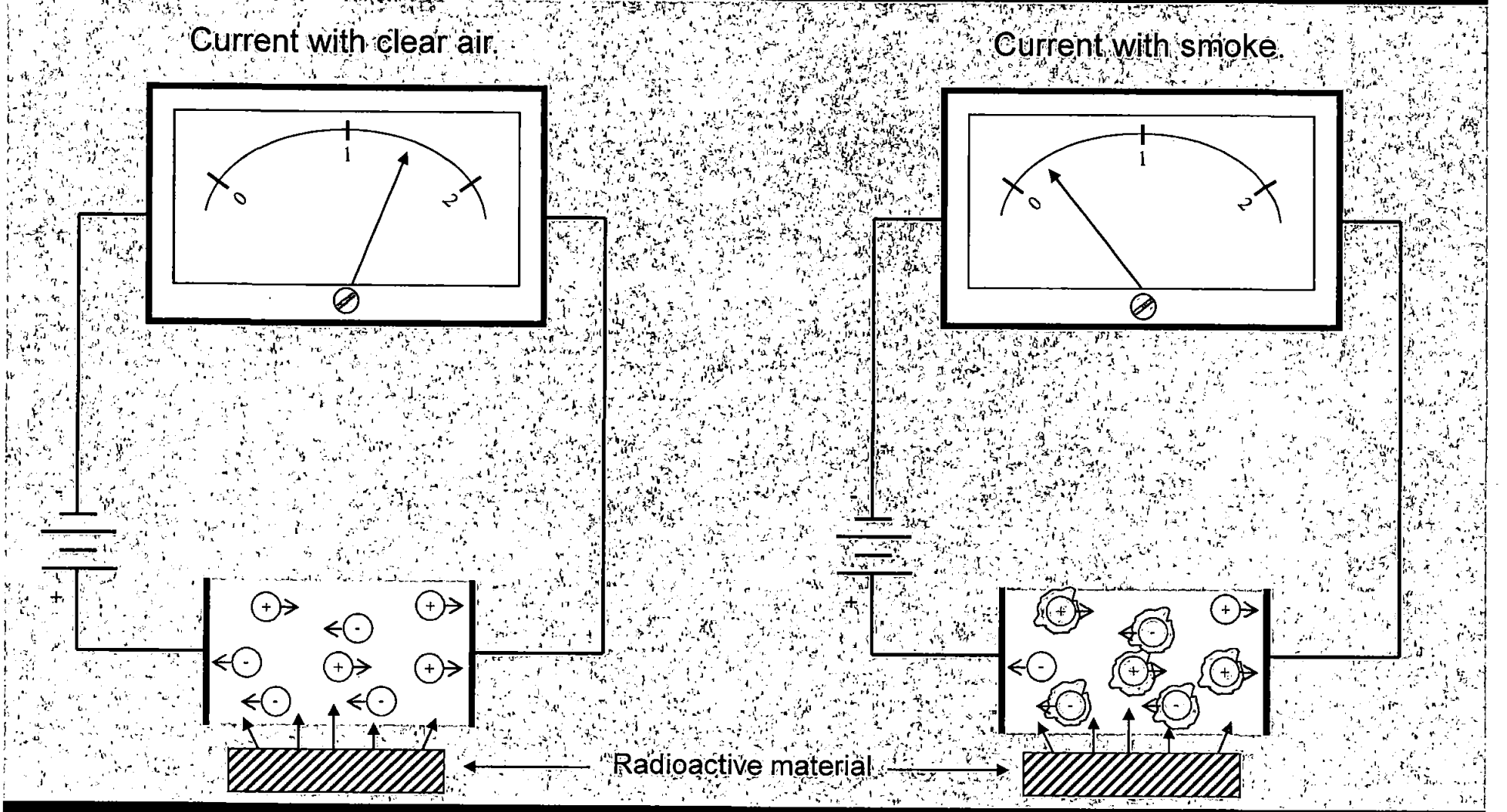


Exhibit 1.18 NFPA 72 Fire Alarm Code Handbook 1999 Edition

Ionization Characteristics

- Smoke Color
  - Not a significant factor
- Particle Size
  - More responsive to invisible particles (smaller than 1 micron in size) produced by most flaming fires.
  - Less responsive to larger particles of smoke typically produced by most smoldering fires.

Ion Attachment

- Ion attachment is accomplished more easily for smaller smoke particles.
  - Research has concluded that when a smoke particle doubles in size, the effect on an ionization detector is 1/4th of what it was previously.

Photoelectric Types

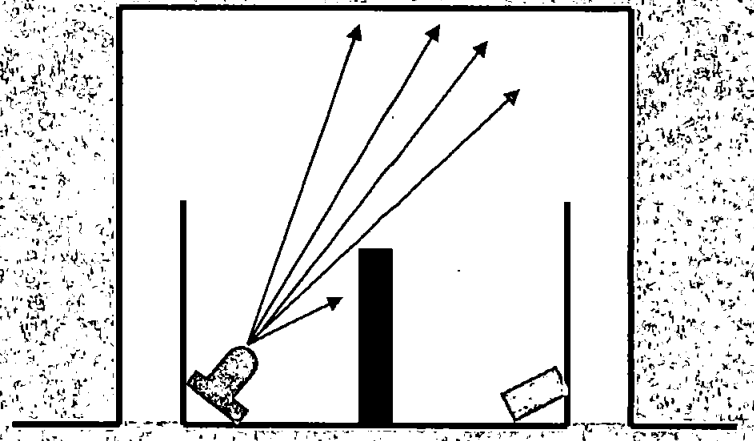
- Light Obscuration
  - Usually line type detectors, better known as "projected beam detectors."
  - Typically not affected by the color of the smoke.
  - Typically not used in sleeping room applications.
- Light Scattering
  - Typically spot-type detectors

Light Scattering Principle

- Inside the smoke detector's chamber exists a light source and a photosensitive sensor.
  - The photosensitive sensor is arranged so that rays from the light source are not directed on to it.
  - When smoke particles enter the chamber some of the light is scattered by reflection and refraction onto the sensor.
  - The light signal is processed and used to convey an alarm condition when it meets preset criteria.

Light Scattering Principle

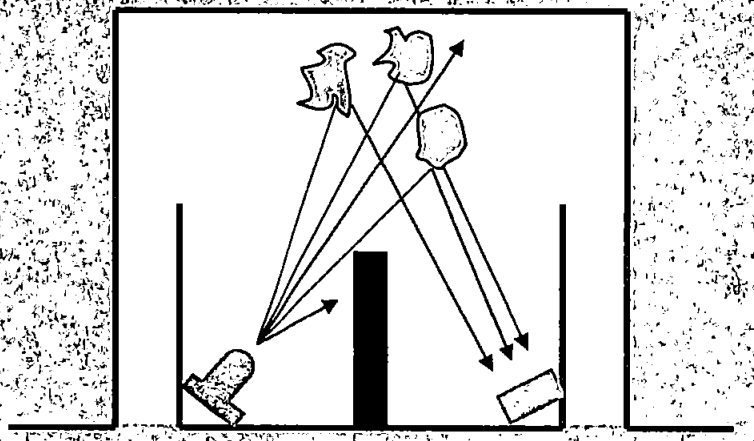
Chamber with clear air.



Light Source

Photosensitive Sensor

Chamber with smoke.



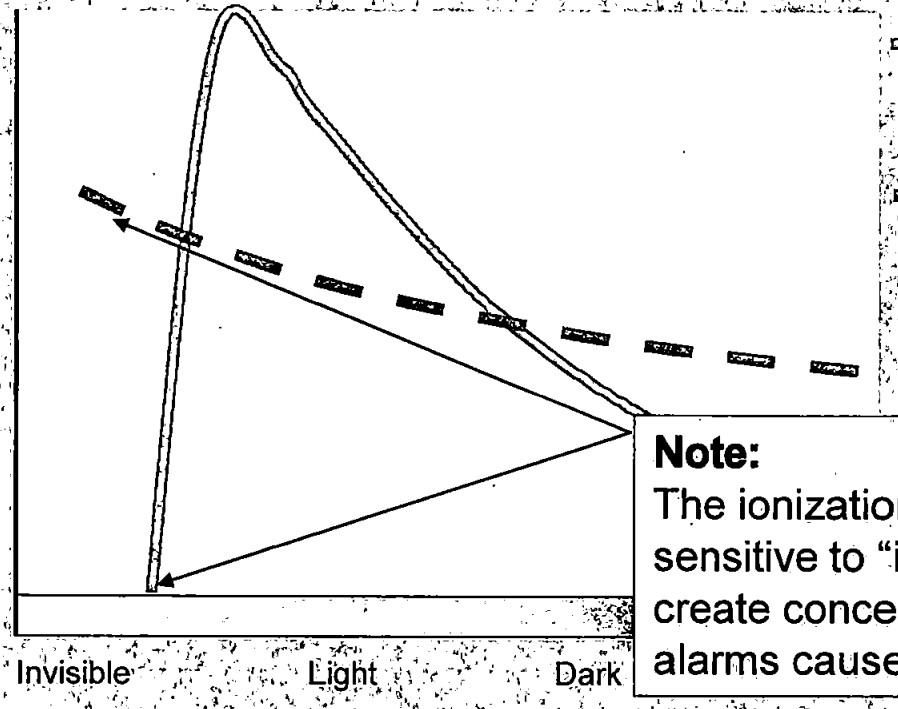
Light Source

Photosensitive Sensor

Photoelectric Characteristics

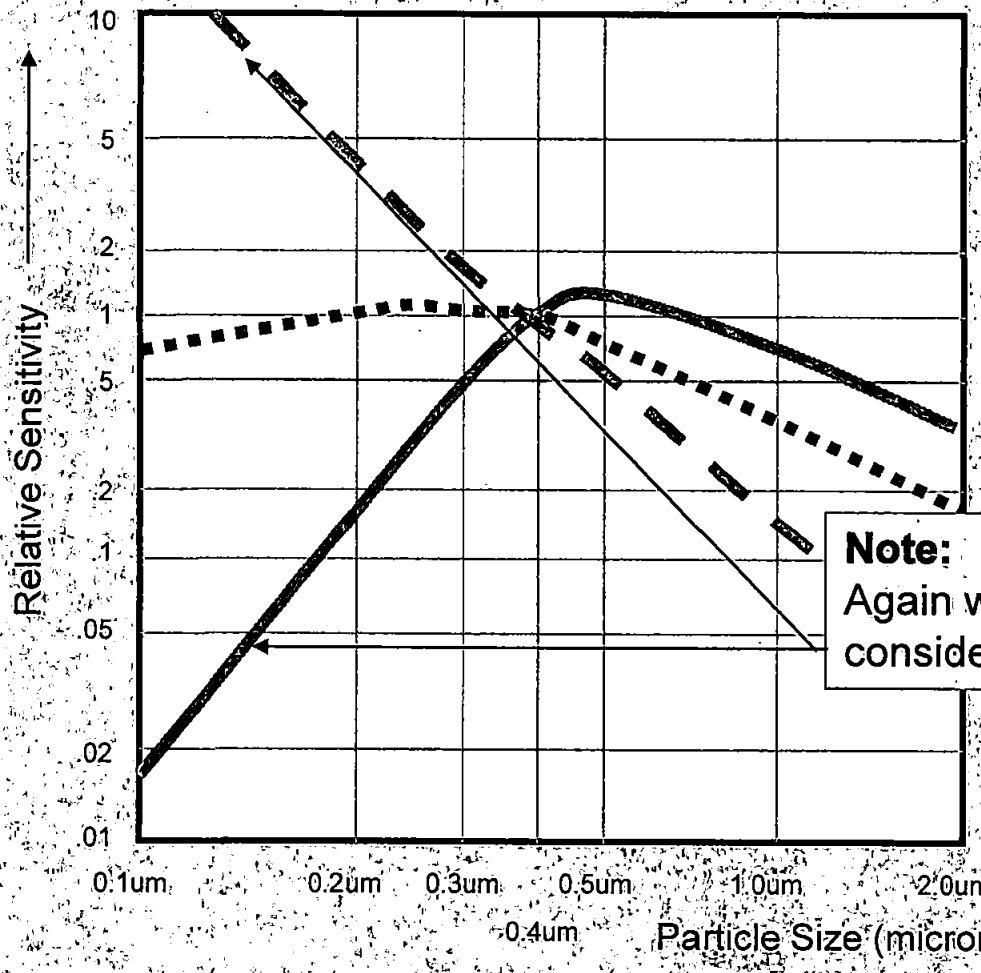
- Smoke Color
  - Less responsive to dark or black smoke.
    - Hydrocarbon Fuels, Some Plastics
  - More responsive to lighter colored or gray smoke
    - Paper, Wood, Fabrics
- Particle Size
  - More responsive to visible smoke particles (larger than 1 micron in size) typically produced by most smoldering fires.
  - Less responsive to smaller invisible particles typically produced by most flaming fires.

Response Sensitivity (Smoke Color)



Note:
The ionization detector is considerably more sensitive to "invisible smoke". This can create concerns in regards to nuisance alarms caused by cooking odors.

Response Sensitivity (Particle Size)



Photoelectric Light Scattering Type Smoke Detector

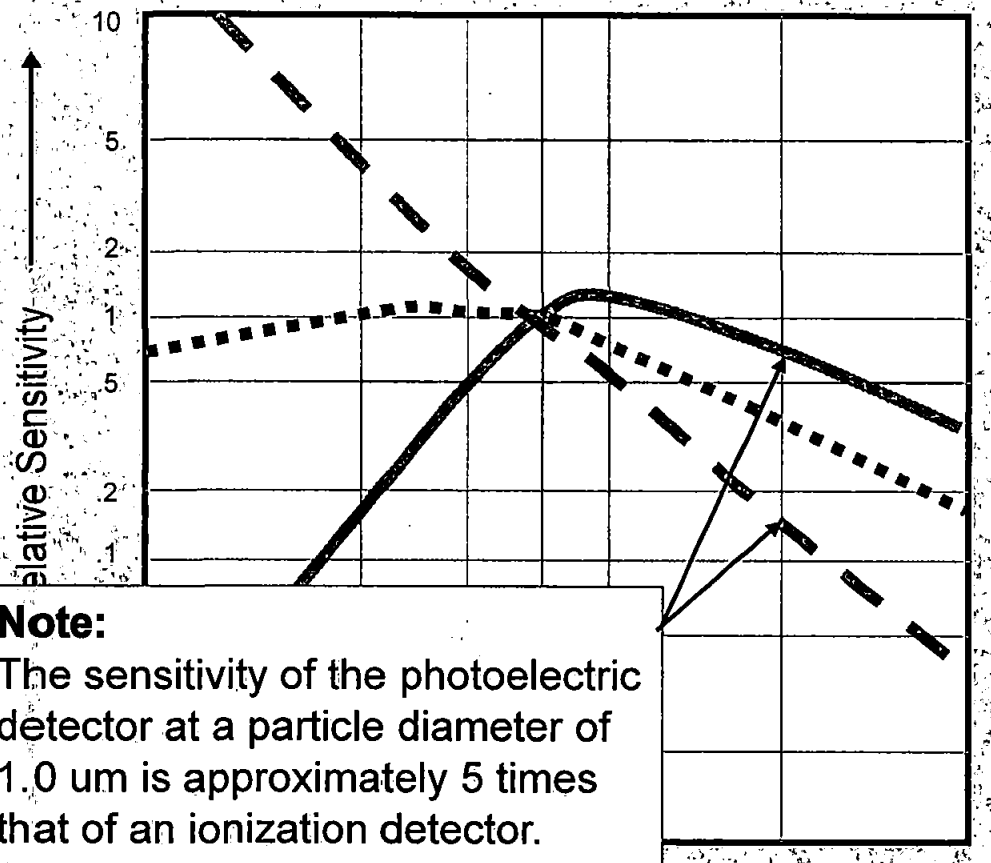
Ionization Type Smoke Detector

Note:
Again we see the ionization detector considerably more sensitive to "invisible smoke."

Fast Flaming Fires = .01 to 3 microns

Slow Smoldering Fires = .3 to 10 microns

Response Sensitivity (Particle Size)



Note:
The sensitivity of the photoelectric detector at a particle diameter of 1.0 um is approximately 5 times that of an ionization detector. (.75 - .15)

Photoelectric Light Scattering Type Smoke Detector

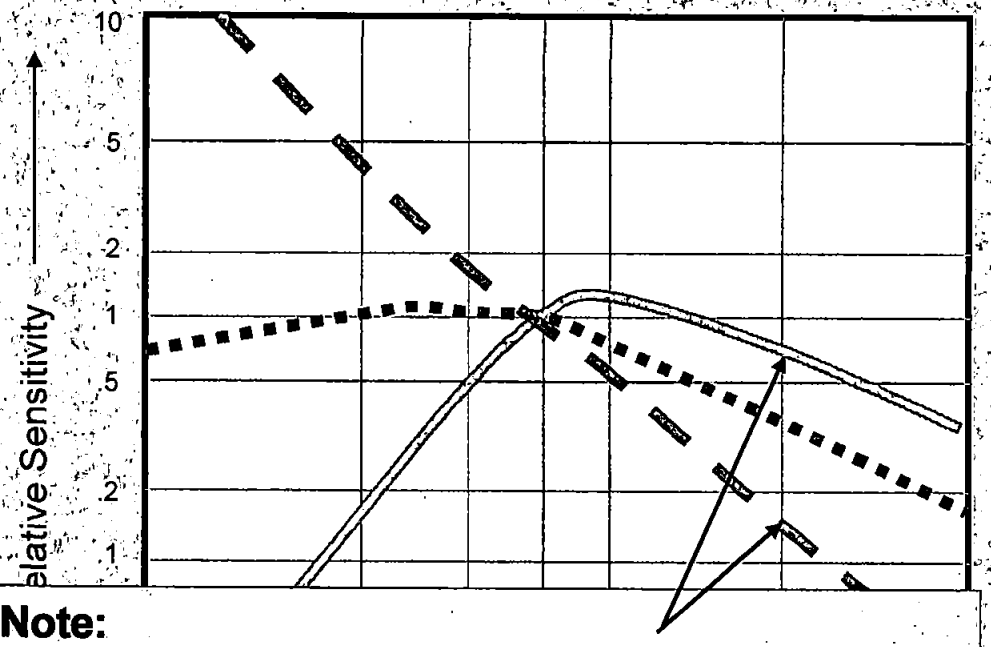
Ionization Type Smoke Detector

Photoelectric Projected Beam Type Smoke Detector

Fast Flaming Fires = .01 to 3 microns

Slow Smoldering Fires = .3 to 10 microns

Response Sensitivity (Particle Size)



Note:
Projected out to the full range of slow smoldering fires (.3 to 10 microns), the photoelectric detector's sensitivity continues to increase over the ionization detector in regards to the larger particle size.

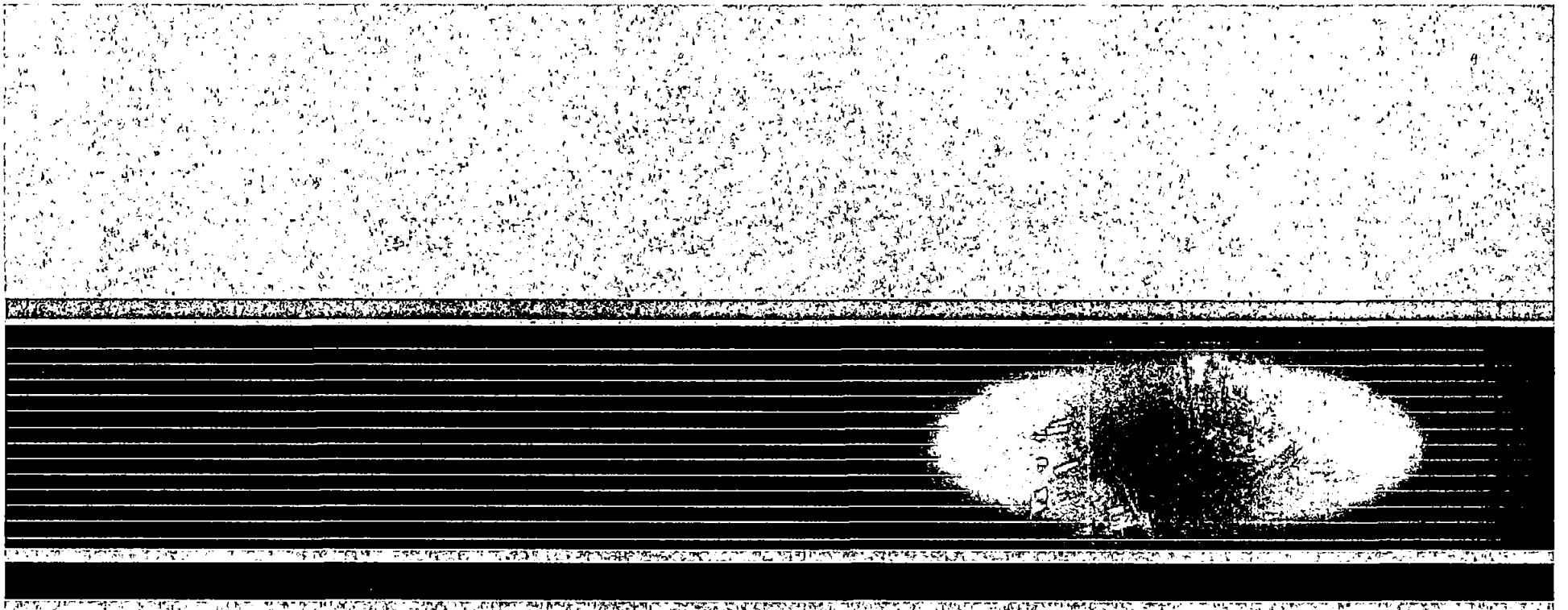
Photoelectric Light Scattering Type Smoke Detector

Ionization Type Smoke Detector

Photoelectric Projected Beam Type Smoke Detector

Fast Flaming Fires = .01 to 3 microns

Slow Smoldering Fires = .3 to 10 microns



Nuisance Alarms

The Result Of Nuisance Alarms

- Nuisance alarms invariably lead to the disabling of smoke detectors / smoke alarms.
  - NFPA analysis indicates that about 1/3 of smoke alarms installed in homes are inoperative.
    - An IAFC Foundation study found that the typical reason was a disconnected or missing power source.
    - Estimates now project that the number of homes with inoperative smoke alarms exceed the total amount of homes with no smoke alarms installed at all.
  - In a National Fire Data Center publication "Fire in the United States, 1985-1994, it is indicated that in apartment fires, detectors were present and did not operate in 20% of the deaths.

Nuisance Alarms

- Several studies have been done since the late 70's on the most common causes of nuisance alarms.
  - Consumer Product Safety Commission
  - Woodlands, TX Study
  - Maryland Study
  - Veterans Administration Study

Nuisance Alarms

- In every study, cooking odors were the number one cause of nuisance alarms.
  - Top Nuisance Alarm Causes
    - Cooking/Baking (As high as 80%)
    - Malfunction
    - Fireplace / Woodstove
    - Steam From Bathroom
    - Cigarette Smoking

Nuisance Alarms

- **NFPA 72, 2010 29.8.3.4** (4)* Smoke alarms and smoke detectors shall not be installed within an area of exclusion determined by a 10 ft radial distance along a horizontal flow path from a stationary or fixed cooking appliance, unless listed for installation in close proximity to cooking appliances. Smoke alarms and smoke detectors installed between 10 ft and 20 ft along a horizontal flow path from a stationary or fixed cooking appliance shall be equipped with an alarm-silencing means or use photoelectric detection.
- *Exception: Smoke alarms or smoke detectors that use photoelectric detection shall be permitted for installation at a radial distance greater than 6 ft from any stationary or fixed cooking appliance when the following conditions are met:*
  - *(a) The kitchen or cooking area and adjacent spaces have no clear interior partitions or headers and*
  - *(b) The 10 ft area of exclusion would prohibit the placement of a smoke alarm or smoke detector required by other sections of this code.*

Woodlands, TX Study

In Woodlands Texas, the high frequency of nuisance alarms caused the authorities to study both types of smoke alarms. Ionization and photoelectric smoke alarms were placed side by side in selected apartments for this study.

Type Of Alarm	Type Of Detector		Total By Alarm Type
	Ionization	Photoelectric	
Cooking	78	5	83
Malfunction	26	5	31
Heater	4	0	4
Cigarette	1	0	1
A/C Unit	3	0	3
Shower	3	0	3
Human Error	0	1	1
Totals:	**115**	**11**	**126**

Agglomeration and Aged Smoke

Agglomeration & Aged Smoke

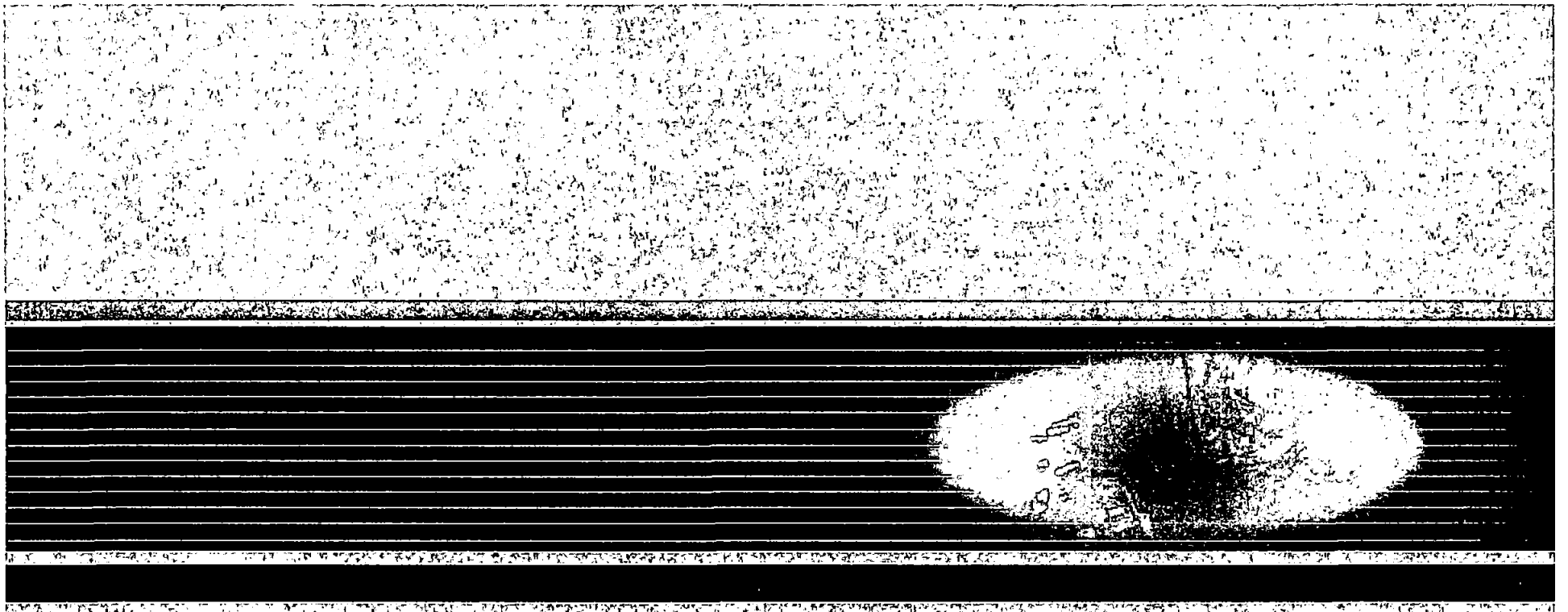
- Agglomeration occurs when small smoke particles begin sticking together to form larger smoke particles.
  - Agglomeration happens very close to the combustion zone in slow smoldering types of fires.
    - Partially why a photoelectric detector will provide better sensitivity to this type of fire.
  - As smoke "ages" when it travels farther from the source of combustion, agglomeration also occurs.
    - This can affect ionization type detectors even in fast flaming types of fires.

Hilton Hotel, Houston - 3/6/82

- NFPA investigation documents ionization type single station smoke alarms in the guest rooms.
  - Guests interviewed indicated that the smoke alarms in their rooms did not activate.
    - Most were awakened by other means to find their room full of smoke
    - Some guests were as close as across the hall from the fire.
    - Some guests reported dizziness and weakness upon awakening.
  - The first detector activated was a photoelectric type located in an elevator lobby 4 floors away, when a guest had propped the door open to clear the smoke from her room.

Prudential Bldg.. Boston - 1/2/86

- A fast growing fire broke out on floor 14 of a 52 story office building.
  - Grew rapidly to involve all the combustibles on the floor (13,000 square feet).
  - Detection consisted of ionization detectors in elevator lobbies and electrical closets.
  - Ionization detectors on most of the upper floors never activated during the 2+ hour incident even though smoke was known to have been thick in these locations within 4 minutes of the fire.



Studies On Detector Response

Studies On Detector Response

- Norwegian 1991
- Factory Mutual 1988
- Ft. Lauderdale 1984
- Indiana Dunes 1975
- Indiana Dunes II 2002?

Norwegian Study 1991

Both photoelectric and ionization detectors were placed adjacent to each other in both the room of origin, approximately 6 feet away from the fire, and right outside the room of origin approximately 12 feet away from the fire.

Detector Location	Smoldering Fire Response (seconds)	
	Photoelectric	Ionization
Smoke Detector in Room of Origin	2,500 - 3,000	5,000 - 5,500
Smoke Detector Outside Room of Origin	7,000 - 8,000	N/A

Note:
In smoldering fire tests the ionization detector responded at best 66+ minutes later than the photoelectric detector did. The ionization detector outside the room did not respond at all.

re Response (seconds)	
	Ionization
	30 - 60
	220 - 240

Norwegian Study 1991

Both photoelectric and ionization detectors were placed adjacent to each other in both the room of origin, approximately 6 feet away from the fire, and right outside the room of origin approximately 12 feet away from the fire.

Note:
In flaming fire tests the ionization detector responded slightly faster than the photoelectric detector did in the room of origin, however the photoelectric detector responded faster of the detectors located outside the room.

ring Fire Response (seconds)	
ic	Ionization
00	5,000 - 5,500
00	N/A

Detector Location	**Flaming Fire Response (seconds)**	
	Photoelectric	Ionization
Smoke Detector in Room of Origin	60 - 100	30 - 60
Smoke Detector Outside Room of Origin	170 - 210	220 - 240

Factory Mutual Study 1988

Eight flaming tests and four smoldering tests were performed in a simulated hotel sleeping room and corridor. Various ventilation conditions were used both with the room door open and closed.

FM Smoke Detector Tests Response (seconds)					
Description of Fire	**Test Number**	**Detector In Room**		**Detector Out Of Room**	
		Photoelectric	Ionization	Photoelectric	Ionization
Flaming Fire - Chair	1	55-180	36-53	247-255	238-250
	3	85-182	32-42	221-249	222-231
Flaming Fire - Bed	5	27-88	28-38	160-176	143-144
	7	53-61	22-34	108-193	106-195
Smoldering Fire	9	1320-1680	3120-3180	3180-3240	3180-3240
	11	240-1020	720-1200	3180-3240	3180-3240

* Even numbered tests were done with the door closed. In these tests the sprinkler usually operated before the detector in the hallway.

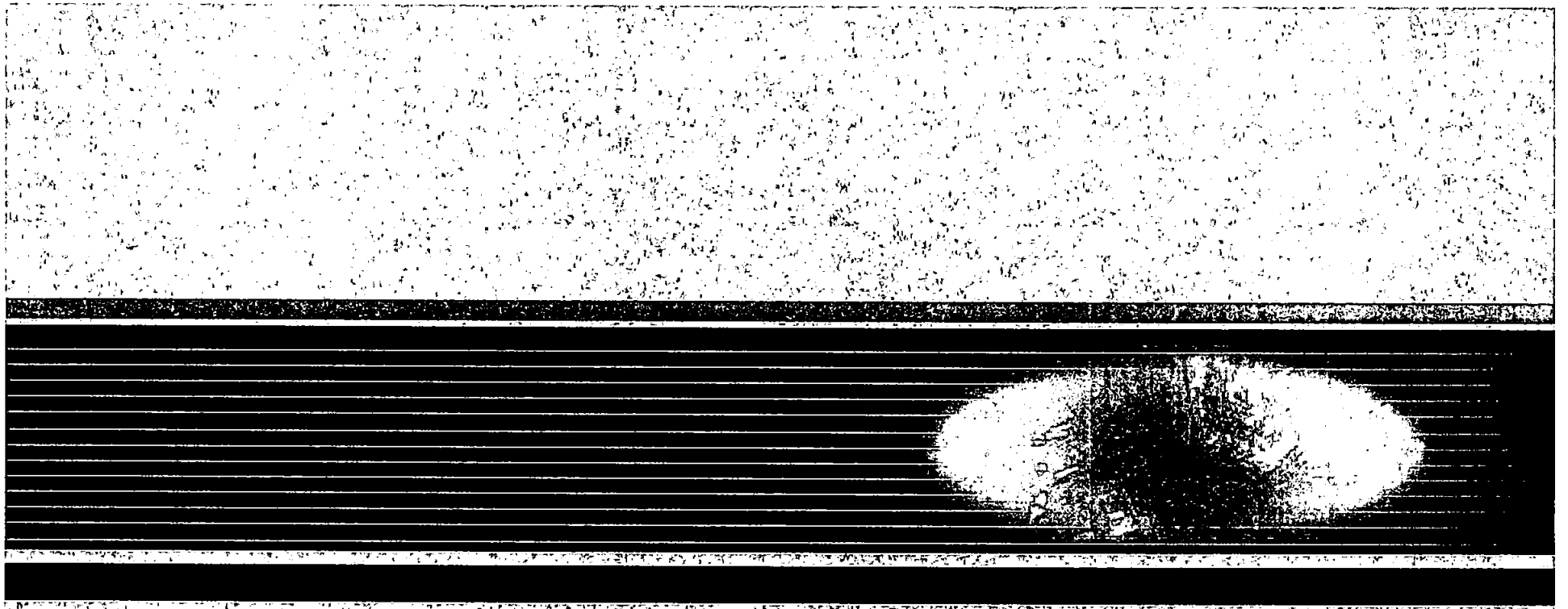
A follow-up study was done using smoldering fires only. With the corridor ventilated at 200cfm, only the photoelectric detector provided adequate warning before untenable conditions in the corridor were reached.

Ft. Lauderdale 1984

- Some Of The Conclusions:
  1. The photoelectric detectors operated an average of 13.2 seconds after the ionization detectors in the flaming fires.
  2. The photoelectric detectors operated first in the smoldering fire.
  3. The photoelectric detector operated 1 hour, 8 minutes, 29 seconds before the first ionization detector in the smoldering fire. In this test, all photoelectric detectors in the room, as well as the photoelectric detectors in the corridor beyond the closed door, responded before the first ionization detector.

Indiana Dunes 1975 & 2002

- Indiana Dunes I - 1975
  - Did not find an advantage of one detector over the other.
    - Tests were done when the standard was one smoke detector per level rather than per room.
  - Many changes since then.
    - UL has changed the minimum sensitivity on ionization detectors from .2% per foot obscuration to .5% per foot obscuration to help reduce false alarms.
    - Detector technology has advanced.
- Indiana Dunes II - 2002
  - Broad scope of tests crucial to evaluating the performance of sleeping room smoke detectors.
  - Completed by 2002



Summary

Ionization Pros & Cons

- Typically provides a slightly faster response to fast flaming type fires when placed in the room the fire originates in.
- Is many times more susceptible to nuisance alarms caused by cooking odors which can lead to disabling of the detector especially in residential applications.
- Is slower to respond to larger smoke particle sizes typically associated with slow smoldering type fires, and “aged” smoke.

Photoelectric Pros & Cons

- Typically provides a much faster response to slow smoldering type fires both inside and outside the room the fire originates in.
- Is much more immune to nuisance alarms caused by cooking odors.
- Is much more sensitive to “aged” smoke.
- Is typically slightly slower to respond to fast flaming types of fires.

Sleeping Room Applications

- When determining the type of detector for sleeping rooms consider:
  - Primary concern is to alert a sleeping occupant as early as possible.
  - NFPA and British studies conclude that the vast majority of fire fatalities occur in slow smoldering fires.
    - NFPA Study
      - 2/3 of the deaths in one & two fatality fires happen between 8 PM and 8AM.
      - In 38% of these deaths the fire was known to have gained large head starts of over 40 minutes.
    - British Study
      - 23,082 fast flaming fires - 4 fatalities. (1 in every 5,770 fires.)
      - 5,870 slow smoldering fires - 20 fatalities. (1 in every 293 fires.)

Sleeping Room Applications

- Most ignition sources that lead to fast flaming fires involve people.
  - It is difficult to imagine a scenario where someone could be involved in the cause of a fast flaming fire, and then fall asleep so fast that they needed a smoke detector to alert them.
- Although fast flaming fires can occur while people are sleeping, many authorities conclude that the odds are more likely a sleeping room fire will start as the slow smoldering type.

- Given this information, photoelectric smoke alarms are the best possible answer for sleeping room applications.

Industry Trends

- Ionization Smoke Alarms With "Hush" Switches
  - Band-aid approach to lessening the affects of nuisance alarms.
  - Multiple nuisance alarms may still lead to disabled smoke alarms / detectors.
- Combination Photoelectric / Ionization Smoke Alarms
  - Can provide earlier detection of slow smoldering type fires than a standard ionization smoke alarm.
  - Ionization portion of the unit is still susceptible to nuisance alarms.
  - To keep costs reasonable many manufacturers utilize less expensive photoelectric and ionization components.

Credits

- The content of this presentation was developed partially from research and data published in the following reports:

Smoke Detector Technology
And
The Investigation Of Fatal Fires

Joseph M. Fleming
Deputy Chief/Fire Marshal
Boston Fire Department

Photoelectric vs. Ionization Detectors
A Review Of The Literature

Joseph M. Fleming
Fire Prevention Division
Boston Fire Department

Thank you for attending

For more information please contact:

Gentex Fire Protection Group

10985 Chicago Drive
Zeeland, MI 49464

800.436.8391 Voice
800.436.8392 Fax

www.gentex.com

Smoke Alarm/Detector Symposium

June 28, 2010

University of Cincinnati

Larry Bennett, Esq, Chairman of Fire Science and Emergency Management

Notes from Captain Clayton James, Newport (KY) Fire/EMS

Smoke Detectors: What to tell the Public?

Important Links:

UC Fire Science- Officer Development Seminars:
http://www.uc.edu/cas/firescience/Bennett/ODS.aspx

Video Footage of Smoke Detector 2010 Seminar:
http://www.uc.edu/cas/firescience/Bennett/fire_detector_seminar.asx

Smoke Detector Seminar PowerPoint Presentation:
http://www.uc.edu/cas/firescience/forms/SmokeDetect.pdf

Smoke Detector Position Paper from the Southwest Ohio Fire Safety Council:
http://www.uc.edu/cas/firescience/forms/SmokeDetectorsSOFSC5-10.pdf

IAFF Press Release on Photoelectric Smoke Detectors, dated October 29, 2008:
http://www.iaff.org/comm/press/102908Smoke.htm

Key Facts to Remember:

Texas A&M Study: Risk Analysis of Residential Fire Detector Performance
"The probability of the failure of the photoelectric detector to detect a smoldering ignition fire is 4.06% while the ionization detector provided a 55.8% probability of a failure in a similar type of fire.

"During a flame ignition fire, the photoelectric smoke detector had a 3.99% probability of a failure to detect the fire while the ionization smoke detector probability of failure to detect the fire is 19.8%."

Beware of Dual Sensor! Currently, there isn't a clear test standard for dual sensor detectors.

Current Smoke Detector Endorsements:

Organization	ION	Photo	Dual Sensor	Buy one of each
IAFF		X		
IAFC			X	
NFPA				X
USFA			X	X
CPSC				X
NIST				X
NASFM			X	X
World Fire Safety Foundation		X		

Smoke Detectors: What to tell the Public?

Recommendation:

1) Develop a position statement on the matter from the NKFA. Fire departments in Northern Kentucky can point to this position statement instead of re-inventing their own perspective on the issue. Include this position statement in this year's Fire Prevention Month campaign.
2) Re-evaluate smoke detector-campaigns that give out / install ionization detectors.
    a. Remember that the citizens most likely to die in a residential fire are the poor, children, and the elderly. These are also likely to suffer a smoldering fire.
3) Seek performance-based legislation for smoke detectors.

<u>A possible suggestion for our message:</u>

- The nature of fire has changed in the last 30 years.
    - Different construction methods and materials.
    - Different materials used in home furnishings.
    - An increased amount of plastics in the home.
- Ionization detectors have done their job well over the last 30 years, but photoelectric detectors are a better choice for installation in today's residential homes.
    - Photoelectric detectors can alarm much faster than the older ionization-type detectors for slow, smoldering fires.
    - Photoelectric detectors are just as fast as the older type at detecting fast, flaming fires.
    - Photoelectric detectors are less prone to false activations from cooking and steam than the older type detectors because of the way they work.
- Photoelectric detectors should be installed as soon as possible in the home and replaced every ten years. Batteries should be changed every 6 months.
- On average, a photoelectric detector is about $4 more than the older type. They are indicated with a "P" on the label or the words "Photoelectric" on the package.

3901 Liberty Street Road • Aurora, Illinois 60504-8122
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

---

[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.

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

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**

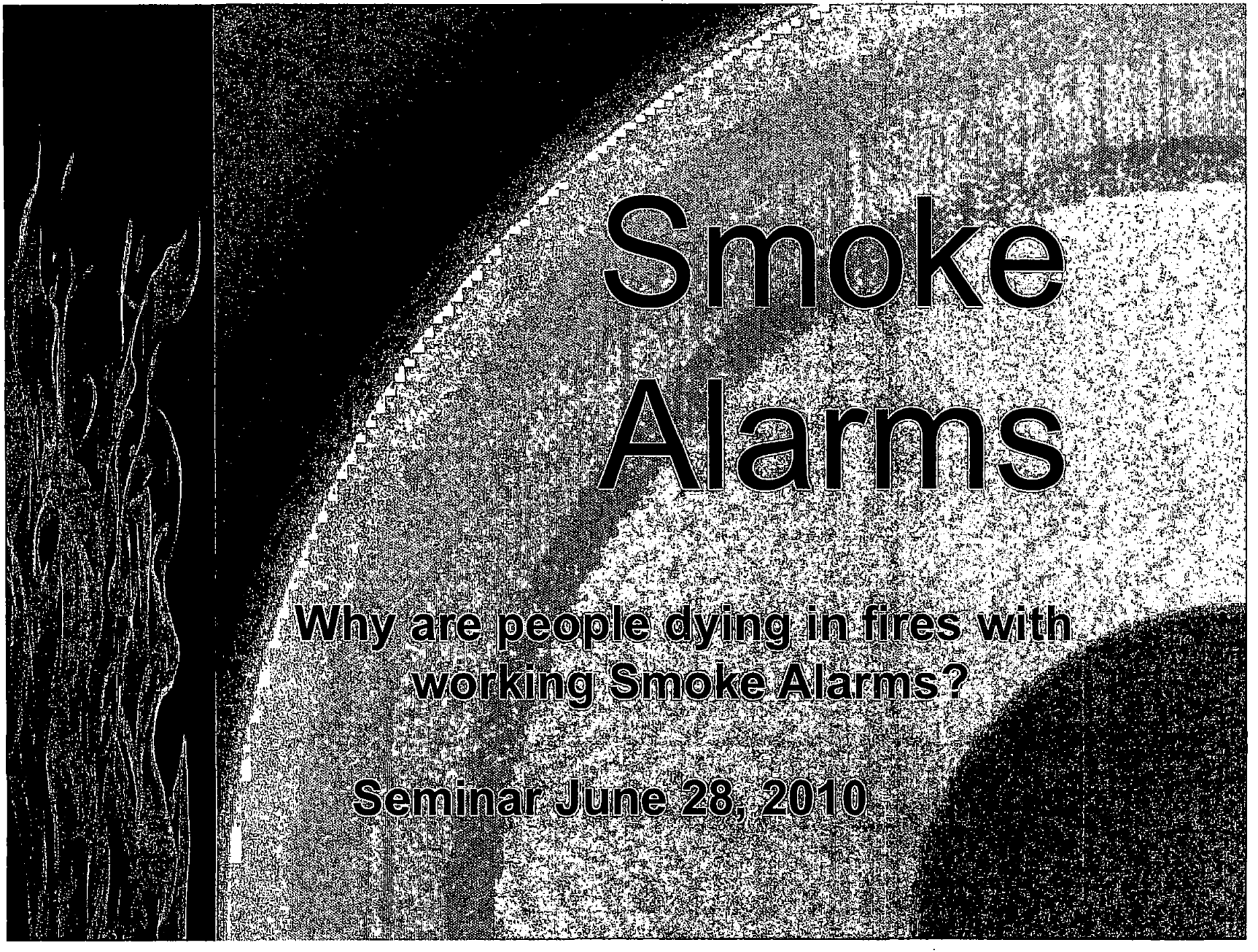
Few entities exist that dedicate more time and resources towards safety-related public policy and education as effectively as the fire service. Please use this information in your safety education efforts. You are encouraged to contact our External Communications department with any questions or concerns. 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.

Father's For Fire Safety of Ohio

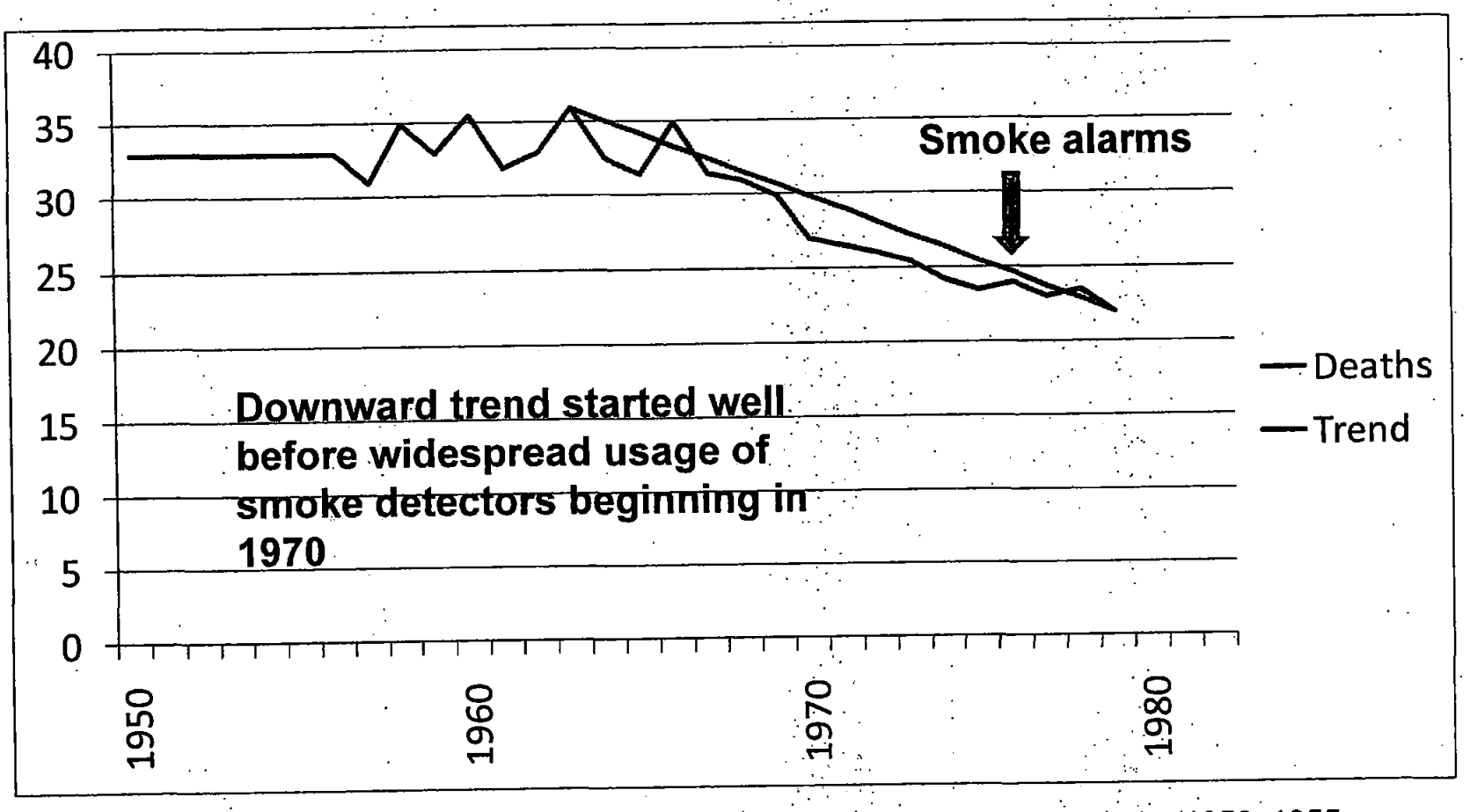
University of Cincinnati, June 28, 2010

Dean Dennis and Doug Turnbull tour the State and the U.S discussing the inadequacies of ionization alarms while promoting photoelectric smoke alarms. Dean lost his daughter along with five other students in a tragic 2003 off-campus house fire at Ohio State University despite a hard wired ionization detection system was so called "operational". Four smoke detectors never sounded. Doug lost his daughter in a Miami of Ohio off-campus house fire with two other women when 17 hardwired ionization detectors failed to sound. Dean and Doug will be giving a power point presentation at the California Fire Chiefs' Convention September 22.

Abridged version


Smoke Alarms
Why are people dying in fires with working Smoke Alarms?
Seminar June 28, 2010

Fire Deaths per Million People 1950 - 1980



Civilian deaths per million people from fire and flame in the United States, (1950, 1955-1979) Source: National Safety Council

WHITE PAPER

HOME SMOKE ALARMS
AND OTHER FIRE DETECTION
AND ALARM EQUIPMENT
Public/Private Fire Safety Council
April, 2006

"The home fire death rate relative to number of fires is essentially unchanged from 1977 to 2003.[3]"

3. Rates are calculated using fire statistics from reference [1] and previous reports in series, and population data from *Statistical Abstract of the United States 2004-2005, U.S. Census Bureau, Washington, DC, 2004.*

Results of the Tests

The data for the smoldering smoke tests show that typically the **photoelectric detectors set to 2.5 %/ft responded 12 - 18 minutes earlier than the Type A ion detectors set to 1.3 %/ft.** Table 2 shows that **when both were evaluated at 0.5%/ft, the photoelectric detectors typically responded 25 - 30 minutes faster than the Type A ion detectors**. As Tables 1 and 2 show, **in the UL 268 Flammable Liquid Fire tests, there was no significant difference in response time between the photoelectric** and Type A ion detectors whether compared at their default sensitivities (2.5 %/ft and 1.3 %/ft) or the same, higher sensitivity (0.5 %/ft).

- **Statement in Report: "Note that not all ions alarmed in all smoldering tests."**

  According to NIST in 2001

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

Thomas Cleary
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, MD
(301) 975-6858
thomas.cleary@nist.gov

Abstract

The UL Standard 217, *"Single and Multiple Station Smoke Alarms" allows for dual sensor alarms so long as the each sensor is primarily a smoke sensor and the design meets the Standard [6]. The alarm logic is an {OR}-type such that the alarm is activated if either the photoelectric sensor or ionization sensor alarm threshold is met.* ***The individual sensor sensitivities are not tested separately. Therefore, manufacturers have the freedom to set each sensor's sensitivity separately. Since an individual sensor can be set to meet all current sensitivity standards, it is not obvious what overall benefit is achieved from a dual alarm with an additional sensor technology that could be more or less sensitive than what would be found in a standalone unit employing such a sensor.*** *Additionally, another potential benefit of a dual sensor alarm may be realized by adjusting each sensor's alarm threshold to reduce nuisance alarms. Thus, the sensitivity of each sensor factors into the overall performance of a dual alarm.*

- *Presented at the Fire Protection Research Foundation's 13th annual Suppression and Detection Research & Applications Symposium (SUPDET 2009)**, February 24-27, 2009,** Orlando, FL*

"False Alarms and Unwanted Activations"

From:

U.S. EXPERIENCE WITH SMOKE ALARMS
AND OTHER FIRE DETECTIONAL/ALARM EQUIPMENT

By: Marty Ahrens
Fire Analysis and Research Division
National Fire Protection Association

- **Ionization devices had a disproportionate share of nuisance alarms.**
- Cooking smoke tends to contain more of the smaller particles (less than one micron) that activate an ionization-type device rather than the larger particles that activate a photoelectric-type device. In the National Smoke Detector Project, **97% of the devices tested for involvement in nuisance alarms were ionization-type devices.**
- Most people do not automatically assume a sounding smoke alarm is an emergency situation. In some cases, they know what caused the alarm and know that they are safe. However, lives have been lost when real alarms were mistakenly considered false. Unwanted activations can generate a dangerous sense of complacency.

November 2004

Statement for the Record

National Institute of Standards and Technology

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.

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

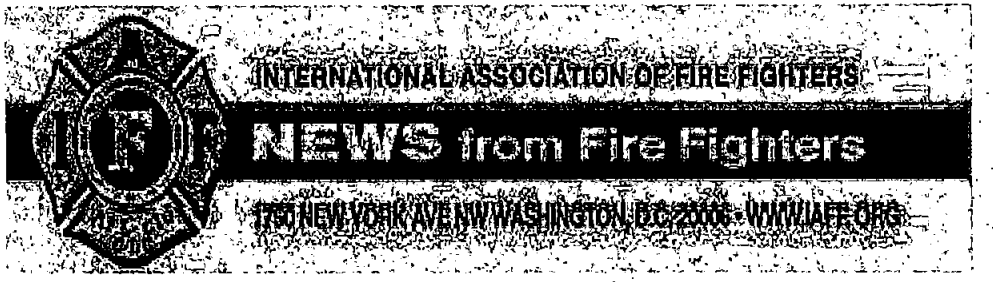
"however, ionization alarms may not always alarm even when a room is filled with smoke from a smoldering fire."

- "As illustrated in the article, the various types of fire detectors provide different levels of risk which supports the need for a change in the current thought process of many fire officials. 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."

- "For example, during a smoldering ignition fire, the photoelectric smoke detector offered the most reliable method of detecting the fire while the room of origin was still in a tenable condition."

- **"The probability of the failure of the photoelectric detector to detect a smoldering ignition fire is 4.06% while the ionization detector provided a 55.8% probability of a failure in a similar type of fire.** This high probability of a failure of the ionization detector can be contributed to a number of factors such as performance under normal conditions and an inability to consistently detect smoldering smoke particles. This is a very important consideration since most of the fires that occur in residences start out as smoldering ignition fires."

- **"During a flame ignition fire, the photoelectric smoke detector had a 3.99% probability of a failure to detect the fire while the ionization smoke detector probability of failure to detect the fire is 19.8%."**



Don't Just Change Your Batteries – Change Your Smoke Detector, Too

- ***Washington, DC*** **– The International Association of Fire Fighters (IAFF) is urging households to change more than just smoke alarm batteries when Daylight Savings Time ends November 2. The IAFF also recommends changing to a photoelectric smoke alarm. About 90 percent of homes are equipped with ionization smoke alarms.**

Click

The International Association of Fire Chief's Residential Smoke Alarm Report (9/80, excerpt)

The Fire Chief's Recommendation

What kind of detector should the fire chief recommend - ionization or photoelectric? The answer to this question, in the subcommittee's opinion, is clear.

It is the subcommittee's belief that only the photoelectric detector will meet the requirements reliably when subjected to both open flame and smoldering fires.

The subcommittee believes this has been proven time after time throughout the country in actual tests conducted by manufacturers and fire departments (see Appendix A).

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:

Vermont Legislation

- **Photoelectric Smoke Alarms**
- Senate Bill S226, passed and requires that "single-family owner occupied homes have a photoelectric smoke detector on each floor and outside any bedrooms. Combination photoelectric and ionization smoke detectors cannot be used as an alternative for these locations because of the false alarms that are more common with ionization. People disarm the detectors. 38% of the smoke detectors in fatal fires had smoke detectors that had been disabled by the occupant. **These detectors must be photoelectric only.** Ionization can be used in addition to the photoelectrics that are required, but must be separate."

- The Governor of Vermont signed the bill on May 29th, 2008 at the Barre City Fire Department

Fire Life Safety Consulting (FLS)

Boston Deputy Fire Chief Jay Fleming is a world renowned expert on smoke alarms/detectors

Smoke Alarm Information:

Smoke Alarm Information (available as a .pdf)

IMPORTANT INFORMATION ON SMOKE ALARMS
(Why Photoelectric Technology is Superior to Ionization Technology)

By Joseph Fleming, President – Fire & Life Safety Consulting Inc. (F&LSC)

INTRODUCTION

I believe that all smoke alarms, even ionization alarms, save lives. However, I feel that photoelectric alarms have the potential to save many more lives. This paper expresses my position on a number of issues related to residential smoke alarms. In particular it will explain the reasons for my belief that all smoke alarms used in residential occupancies should utilize photoelectric technology. This position is based on almost 20 years of research and a review of all of the pertinent literature on the topic.

There are two principle types of smoke alarms, ionization and photoelectric smoke alarms. Ionization smoke alarms predominantly detect the presence of extremely small particles of smoke while the photo-electric smoke alarms predominantly detect visible smoke.

Some organizations indicate that both ionization and photoelectric smoke alarms provide occupants adequate time to escape. **The position of F&LSC however, based on current knowledge about smoke alarm performance is; that photo-electric alarms are generally more effective than ionization alarms across the broader range of fire experienced in homes, and should be promoted as the technology of choice.**

Current, and historical, research (see the end of this article) indicates that:

- Ionization smoke alarms detect flaming fires marginally earlier than photoelectric smoke alarms.
- Photoelectric smoke alarms detect smoldering fires and fires starting in areas remote from smoke alarms significantly earlier than ionization smoke alarms.
- Ionization smoke alarms may not operate in time to alert occupants early enough to escape from smoldering fires.
- For both flaming fires and smoldering fires, photoelectric smoke alarms are likely to alert occupants in time to escape safely.

Smoke alarm provides the greatest benefit to occupants while they are sleeping. Since many residential fires, particularly those that occur while occupants are sleeping, begin as smoldering fires, photoelectric smoke alarms provide more effective all-round detection and alarm than ionization alarms. Homeowners, who currently have ionization smoke alarms may choose to maintain them until the end of their service life. However, homeowners should also install photoelectric smoke alarms in accordance with the locations described below.

Smoke alarms fitted with dual photoelectric/ionization alarms are available. Home owners may choose to install such alarms in lieu of photoelectric alarms. However, research indicates that they are more costly and prone to more false alarms than photoelectric alarms, and the benefits are marginal.

To check to see which kind is currently installed in your home or apartment, take the alarm down from the ceiling. If, on the back of the alarm, the term "Americium 241" or a radioactive symbol appears then it is an ionization alarm. According to a study conducted by the Consumer Product Safety Commission the vast majority

currently installed are ionization, since they are cheaper.

WHERE WOULD I GET SMOKE ALARMS?

Many hardware, home supply, or general merchandise stores carry smoke alarms. Some smaller stores only carry ionization due to a shortage of shelf space, as well as lack of demand, due to the lack of knowledge on the part of consumers regarding the relative benefits of the different technologies. Larger stores and electrical supply stores carry many different types of alarms. Some fire departments offer smoke alarms for little or no cost. (Typically because they are a little cheaper these free smoke alarms use ionization technology.

WHERE SHOULD SMOKE ALARMS BE INSTALLED?

At a minimum, install smoke alarms on every level of your home, including the basement. They should be located on the ceiling, near stairwells, so that any smoke passing by up the stairs will have to pass the alarm. There should be enough alarms on each level so that no room is more than 20 feet from an alarm. If a room is very large and/or has a very high ceiling, it may be prudent to place an alarm in that room.

A smoke alarm's primary function is to awaken sleeping persons and warn them of a dangerous fire. As such, the most important rule for locating a smoke alarm is that the alarm be between the bedrooms and the rest of the house, but closer to the bedrooms. For extra safety, install smoke alarms both inside and outside bedrooms. This is important if occupants sleep with the bedroom doors closed since the smoke from a fire that starts in a bedroom may not reach the smoke alarm in time.

Note: Historically it has been recommended to sleep with bedroom doors closed to keep toxic gases given off by a fire from entering the bedroom. Unfortunately a closed bedroom door may make it much harder to awaken to a smoke alarm that is located on another floor, particularly if a window air conditioner is being used.

Also, smoke alarms should be installed on the ceiling or on the wall 6-12 inches from the ceiling. Never install within six inches of where the wall and the ceiling meet. This is usually dead air space and smoke tends to miss it. Since smoke and many deadly gases rise, installing your smoke alarms at the proper level will provide you with the earliest warning possible. Always follow the manufacturer's installation instructions.

WHERE SHOULD SMOKE ALARMS NOT BE INSTALLED?

Do not place smoke alarms in or adjacent to the kitchen or bathrooms where cooking, steam, etc. might unnecessarily set off the alarm. Do not place smoke alarms near vents, heating ducts, and other sources of air current, which may keep smoke from reaching the alarm. Avoid placing alarms on a ceiling, which is significantly warmer, or colder than the rest of the room because a thermal barrier might exist which prevents smoke from entering the smoke alarm. This is of primary concern with mobile homes, poorly insulated houses, outside ceilings, and outside walls.

WHAT IF THE ALARM GOES OFF WHILE I AM COOKING?

Then it is doing its job. Do not disable your smoke alarm if it alarms due to cooking or other non-fire causes. You may not remember to put the batteries back in the alarm after cooking. Instead, clear the air by waving a towel near the alarm, leaving the batteries in place. The alarm may have to be moved to a new location. In cases of small apartments it may not be possible to relocate the alarm away from the nuisance source and still meet the recommended installation guidelines. Some smoke alarms come equipped with a "silence" button, which can be used to reduce the sensitivity for a period of time. This may not be a good option for the elderly or handicapped, who may not be able to reach the button. Many studies show that photoelectric alarms are less prone to nuisance alarms so switching from ionization to photoelectric should help.

Note: I would like to point out that the use of photoelectric smoke alarms in areas prone to nuisance alarms has even been recommended by the manufacturers of ionization smoke alarms.

HOW DO I KEEP MY SMOKE ALARM WORKING?

Smoke alarms are very easy to take care of. There are three steps to remember:

1. Simply replace the batteries at least once a year. Tip: Pick a holiday or your birthday and replace the batteries each year on that day. Some smoke alarms now on the market come with a 10-year battery.

These alarms are designed to be replaced as a whole unit, thus avoiding the need for battery replacement. If your smoke alarm starts making a chirping noise, it means that the battery is low on power. Replace the batteries and retest it.

2. Keep them clean. Dust and debris can interfere with their operation, so vacuum over and around your smoke alarm regularly.
3. Do not ever paint over a smoke alarm.

HOW LONG WILL MY SMOKE ALARM LAST?

Smoke alarms should last about 8 to 10 years, after which time they should be replaced. Like most electrical devices, smoke alarms wear out. You may want to write the purchase date with a marker on the inside of your unit. That way, you will know when to replace it. (Some newer alarms have the date of manufacture on the alarm.) Always follow the manufacturer's instructions for replacement. Although it is likely that your smoke alarm will still be operational after ten years, it is a reasonable time to consider replacing it.

IN APARTMENTS, WHO IS RESPONSIBLE FOR MAINTAINING THE ALARM?

The responsibility varies from jurisdiction to jurisdiction. Many require the landlord to insure that at the start of a lease the tenant has a working smoke alarm with a new battery. After that it is the tenant's responsibility. In some cases the landlord is required to re-check the alarm and install a new battery yearly. Most require the tenant to notify the landlord of any problems with the alarm. The important thing to remember is that the responsibility is clarified at the beginning of a lease. In cases of excessive nuisance alarms tenants should inform landlords of the options/solutions mentioned earlier. It is unlikely that the landlord is aware of them.

ALARM AUDIBILITY ISSUES

Testing by the Consumer Product Safety Commission has demonstrated that a closed bedroom door could prevent a sleeping occupant from hearing an alarm remote from the bedroom, such as one on another level. If the occupants of the bedroom have a room air conditioner on or are watching television, they may not hear an alarm right outside the room. As a consequence, some experts are re-thinking the traditional advice to always sleep with bedroom doors closed. This advice was given based on studies which showed that a closed bedroom door would delay the time for the occupant to be overcome by products of combustion from a fire that started outside the bedroom. However, if the right kind of alarm is properly installed this should not happen. As a consequence, unless the alarms are interconnected and installed in bedrooms and common areas, occupants should sleep with bedroom doors open, or at least slightly ajar, to insure that they hear the smoke alarms.

COMBINATION CARBON MONOXIDE/SMOKE ALARMS

Unfortunately, at this time (April 2009) many combination Smoke/CO Alarms utilize ionization technology. This may be an attempt to keep the cost as low as possible. Consequently, in order to be adequately protected from fire, which poses a greater risk than CO, if consumers cannot find a Smoke/Co Alarm with photoelectric technology, we recommend that occupants use separate devices.

WIRELESS SMOKE ALARMS

Some manufacturers now sell a wireless smoke alarm that allows all of the smoke alarms to communicate to each other without the need to run wires throughout the house. This is a great solution to the "closed bedroom door" problem since if one alarm goes off all of the alarms go off. Once again, it is critical to purchase an alarm that uses photoelectric technology.

SMOKE ALARM TECHNOLOGY

Photoelectric Smoke Alarm Technology

Photoelectric technology smoke alarms use a T-shaped chamber fitted with a light-emitting diode (LED) and a photocell. The LED sends a beam of light across the horizontal bar of the chamber. The photocell sits at the bottom of the vertical portion of the chamber. The photocell will generate a current, when exposed to light.

The diagram below illustrates how the technology works. Under normal, smoke-free conditions, the LED beam

moves in a straight line, through the chamber without striking the photocell. When smoke enters the chamber, smoke particles deflect some of the light rays, scattering them in all directions. Some of it reaches the photocell. When enough light rays hit the photocell, they activate it. The activated photocell generates a current. The current powers the alarm, and the smoke alarm has done its job.

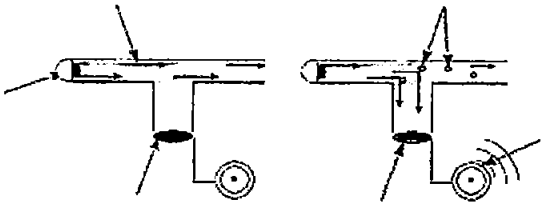
In Smoke Free Chamber Light Beam Travels Straight Through Smoke Particles in Chamber Deflect Some Light Rays

Deflected Light Rays Activate Photocell

Activated Photocell Powers Alarm

No Light Reaches Photoelectric Cell

Light Emitting Diode

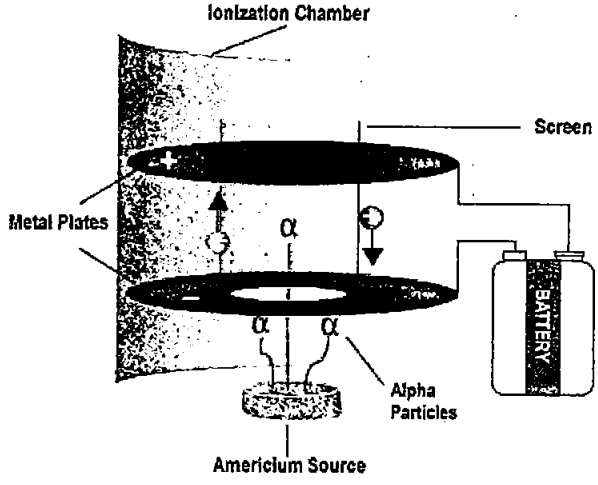


Ionization Smoke Alarm Technology

The ionization chamber is basically two metal plates a small distance apart. One of the plates carries a positive charge, the other a negative charge. Between the two plates, air molecules-made up mostly of oxygen and nitrogen atoms-are ionized when electrons are kicked out of the molecules by alpha particles from the radioactive material (alpha particles are big and heavy compared to electrons). The result is oxygen and nitrogen atoms that are positively charged because they are short one electron; the free electrons are negatively charged.

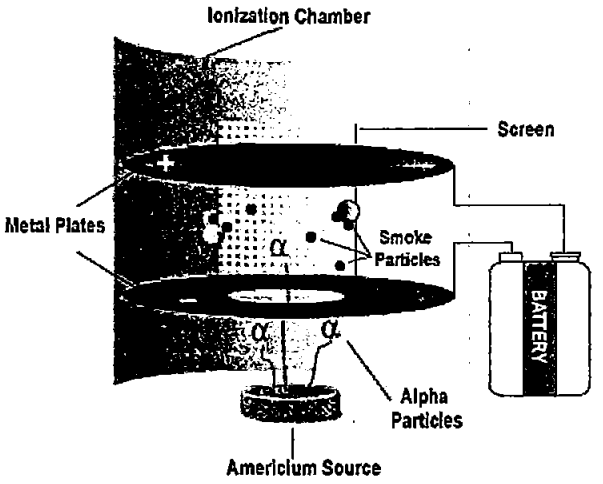
The diagrams below illustrate how ionization technology works. The positive atoms flow toward the negative plate, as the negative electrons flow toward the positive plate. The movement of the electrons registers as a small but steady flow of current. When smoke enters the ionization chamber, the current is disrupted as the smoke particles attach to the charged ions and restore them to a neutral electrical state. This reduces the flow of electricity between the two plates in the ionization chamber. When the electric current drops below a certain threshold, the alarm is triggered.

Alpha particles from the americium source ionize air molecules. In the smoke-free chamber, positive and negative ions create a small current as they migrate to charged plates.



Smoke particles and combustion gases interact with the ions generated by the alpha particles, restoring them to

their neutral electronic state and decreasing the electrical current passing through the cell.



As fewer ions are available to migrate to the plates, the disrupted current triggers the alarm.

Consequences of Different Alarm Technologies

The difference in operational technology between the two alarms is the reason for the ionization alarms higher sensitivity to fast-flaming fires, which produce small particle smoke. It is this same technological difference that causes ionization alarms to be most sensitive to "invisible smoke," i.e. nuisance alarms," while at the same time photoelectric alarms are virtually insensitive to invisible smoke. The operational differences also explain why the photoelectric alarm is far more sensitive to smoldering smoke, which generally contain larger and fewer particles than smoke from flaming fires.

CONCLUSIONS FROM RESEARCH STUDIES

In 1980 a special committee of the International Association of Fire Chiefs reached the following conclusions regarding testing conducted by the Los Angeles Fire Dept.

"Therefore, because of the present state of the art in detecting smoke, the Subcommittee on Smoke Alarms can take no other course but to recommend the installation of photoelectric alarms."

Researchers in Australia reached similar conclusions in 1986. They investigated smoke alarms ability to detect smoldering fire in a typical residential dwelling. Their conclusions were the following:

"Photoelectric alarms sighted in the hallway are more effective for detecting smoldering smoke than ionization alarms, providing adequate escape time for most conditions of size and location of the smoke sources . ***Ionization alarms sited in the hallway generally provide inadequate escape times ... "***

In 1991 Norwegian researcher placed smoke alarms inside and outside the room of origin. They reached the following conclusions.

The ionization alarms detected smoke from a smoldering fire much later than optical (photoelectric) alarms. When the particular conditions during the fire development are taken into consideration there are reasons to indicate ***that this detection principle (i.e. ionization) would not provide adequate safety during this type of fire.***

In testimony provided to the Boston City Council (1997), the National Institute of Standards and Technology stated the following.

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

substantially sooner in these situations. In the NIST experiments the photoelectric detectors sensed smoldering fires on average 30 minutes earlier than the ionization detectors.

More important information, on this topic, can be obtained at the following web-sites.

These 2 addresses link to the **Boston City Council TV Library**.
They involve 2 hearings on Smoke Alarms.

http://www.cityofboston.gov/citycouncil/cc_video_library.asp?id=385
Title: ***Discussion of Smoke Alarm Technology***
Committee: Public Safety
Description: Discussion of smoke alarm technology and the differences between photoelectric and ionization smoke alarms

http://www.cityofboston.gov/citycouncil/cc_video_library.asp?id=401
Title: ***Smoke Alarm Technology, Part I of II***
Committee: Public Safety
Description: Discussion of smoke alarm technology, comparing photoelectric and ionization smoke alarms (follow-up from 7/9/07 hearing), Part I of II

- **http://www.fc-tv.com/webcast/sunmountain/iaff-10-07/portal.asp**
  (Once on this link, go to Monday afternoon speakers and link on. "***The Truth about Smoke Alarms***"
  This is a presentation by Joseph Fleming to the International Association of Firefighters (IAFF) Redmond Symposium, October 22, 2007 Chicago , IL
- **http://www.interfire.org/features/smokedetector.asp**
  This web address will bring one to a paper that I wrote titled " *Smoke Alarm Technology and the Investigation of Fatal Fires* ". It was intended to help fire investigators. It has an in-depth technical explanation of the problem.
- **http://wbztv.com/local/Safe.smoke.alarms.2,588321.html**
  This link will go to a series of news stories on this issue. It includes video of an actual fire tests involving both smoke alarm types. It culminates in a story describing how Massachusetts changed the Building and Fire Codes to restrict the use of ionization smoke alarms.
- **http://www.scribd.com/doc/4445715/ALARMING-Most-Smoke-Detectors-Dont-Detect-Deadly-Smoke**
  This link will go to a series of news stories on this issue. It covers actual fires were an ionization alarm operated too late.

Smoke Alarm Information (available as a .pdf)

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Senator John Kerry's letter to the Consumer Product Safety Commission (CPSC) March 2008

Senator John Kerry Letter

Jun 1st, 2006
Kerry Pushes Consumer Product Safety Commission To Answer For Unsafe Smoke Detectors

BOSTON – Senator John Kerry today sent a letter to the head of the Consumer Product Safety Commission (CPSC), urging her to answer for smoke detectors that have continuously proven to be unsafe. Kerry's letter is a follow up on a letter sent by Deputy Chief Joseph Fleming of the Boston Fire Department, who raised the issue with the CPSC earlier this year.

In his letter, dated March 12, 2008, Chief Fleming drew attention to safety issues surrounding ionization smoke detectors and asked the CPSC to investigate. The CPSC, which had expressed concerns about the detectors as early as 1995, has failed to investigate or to even respond to Chief Fleming's concerns.

"This should be a no-brainer. If smoke detectors are proven to be ineffective, why are they still being used? Chief Fleming rightly raised this question earlier this year. I strongly urge the CPSC to immediately provide answers to his concerns as well as to consider the potential loss of life when Americans are using inadequate and unsafe smoke detectors," said Senator Kerry.

The text of the letter is below:

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

Dear Chairman Nord:

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

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

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

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

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

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

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

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

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

Sincerely,

John F. Kerry

< < < CPSC home page

COMBINATION SMOKE ALARMS: A DANGEROUS COMPROMISE!

DUAL-SENSOR SMOKE DETECTORS

A DANGEROUS COMPROMISE

Recently, many seemingly reputable people have weighed in on the debate regarding the value of the Ionization detector in light of the growing consensus that the Photoelectric detector will save more lives. It is no longer debated that most people die in smoldering fires and that the Photoelectric detector has a clear advantage. The Photoelectric alarms numerous minutes (10-30 minutes) faster than the Ionization, which may even fail to alarm. Still there are those that defend that in flaming fires, the Ionization detector may alarm up to 30 seconds faster than the Photoelectric. The argument presented is why give up the 30 seconds the Ionization may provide? On the surface it appears to be valid argument and the easy answer is becoming to use the dual-sensor detector. What could be better than housing both technologies in one unit? The best of both worlds, right? Wrong. Let us look at how we got to this point, let us discuss why people may still want to defend Ionization technology, and let's examine why the dual-sensor detector is a dangerous solution that will compromise lives.

For years, even decades, the public has been kept in the dark regarding smoke detectors. The consensus among fire officials was that everyone needed a smoke detector, and that goal became a tunnel-vision goal. The mantra was any smoke detector is better than no smoke detector. Now that an estimated 90% of Americans have a smoke detector, an Ionization detector, the behind the door discussion has become, "why haven't they reduced the number of fire deaths we thought they were going to reduce?" and "why are people with a working smoke detector still dying?" The answer is that most Americans have no idea there are two different technologies available to them. From fire officials to government agencies on down, Americans have only been lectured to have a smoke detector. Since Ionizations have been handed out for years (always a couple dollars cheaper than the Photoelectric), and since they have been the profit-life-blood of the smoke detector industry for decades, "leaders" expressed they "didn't want to confuse the public" even after they knew of the differences between the two technologies. The differences being that the Photoelectric had a much greater chance in saving the American family from dying in a fire than the Ionization. After all, over 90% of Americans have an Ionization detector. Who was going to take the blame for sitting on information all these years that could have saved lives? UL approved them, didn't they? The Consumer Product Commission never shared complaints about them with the American public. Companies still manufactured them and discounted them to fire departments, didn't they? NIST conducted tests and said they both types would save lives, didn't they? The NFPA also stated they both would save lives, didn't they? The IAFC never spoke out on the issue. What was expressed to the public was if you had a smoke detector you were safe. Simply put, no one wanted to stir up a liability issue by telling the American public the truth. It can become

costly when people die in fires and fingers can get pointed in a lot of directions. The rationale for keeping quiet was a mixture between preserving ones credibility to limiting ones liability.

Ionization detectors were heavily promoted from the beginning. Some groups didn't really know the tune (the real data) when Ionization detectors first appeared on the scene but sang their song anyway. Years later many of these groups were stuck with what to do when confronted with the real data. The IAFF decided to step up to the plate, but most groups took the ostrich with his head in the sand approach. Excuses ranged from, we are still studying the issue, to if people went to the store with too much information they may become confused and not buy anything, to people may take down their Ionization detector and not replace it with anything. The American public is regarded as incapable of understanding the basic information that numerous tests have provided, and the statistics the government has collected. Simply stated, (1) Ionization detectors are *many minutes* slower to alarm in a smoldering fire but *seconds* faster in a flaming fire when compared to a Photoelectric detector. (2) Most people die from smoke inhalation. (3) Ionization detectors false alarm at a much greater rate than Photoelectric detectors. Presented with these three simple facts, the American public most likely can make a decision to protect their family. Where do we go from here?

Fire "leaders" are at a crossroads. Failing the American public once, because they sat on information, or didn't time to learn, was wrong at the very least. They are now getting a second chance to lead. The easy path might be to keep quiet again or reach simplistic conclusions and tell us dual-sensors are the way to go. It would be easy to take a non controversial stance that would please everybody and allow everyone that promoted Ionization detectors to save face. That decision would be to promote the dual-sensor alarm. It would be a deadly decision however, here is why.

Everyone knowledgeable has stated that all households need Photoelectric detectors. The IAFF (292,000 members), advocates for Americans to replace their Ionization detectors with Photoelectric detectors. The International Association of Fire Fighters is the one group that has shown leadership. Others are debating whether to take the easy position of recommending dual-sensor detector. Let's provide the public with some facts before the "recommenders" recommend. First, it isn't even debatable that the Ionization detector has a problem with false alarming. Numerous studies and surveys have indicated that 20% of people disable their Ionization detectors within a year due to nuisance alarms. The dual-sensor detector operates both technologies off of the same battery. Is it a good idea to leave 20% of all Americans unprotected by recommending the dual-sensor? Second, in court testimony during the notable *Mercer Case,* when an Ionization detector failed to alarm resulting in the death of a child, a company official testified that the dual-sensor alarm is desensitized versus the stand alone technology. Is this what the public wants, a secretly compromised technology in the dual-sensor detector?

Additional concerns need to be raised so the public can better understand the issue. Is the smoke detector industry pairing the controversial Ionization technology with Photoelectric technology so that it can pass the smoke obscuration tests? Is the American public aware that

the stand-alone Ionization is coming under scrutiny in countries like Australia and New Zealand? Shouldn't the American public be informed that a smoke detector should be able to alarm within a 4% smoke visibility per meter, and that fire fighters are required to put on their masks at 10% visibility, but the Ionization detector has failed 50% visibility obscuration tests in other countries. Shouldn't the public be provided with a smoke detector that alarms in time to find a door? This controversy does not follow the Photoelectric detector. Lastly, the American public is not aware of the 4 years of smoke detector research at Texas A&M. Research that found that the Ionization's alarm failure rate was between 18%-56%, depending on the type of fire, while the Photoelectric detectors failure rate was merely 4%. While the average consumer isn't aware of this research, fire officials should be and understand it. What seems clear is that the dual-sensor detector is a convenient compromise. It is a mistake that will cost lives.

Written by Dean Dennis (Fathers for Fire Safety of Ohio); a father who lost his daughter in a 2003 off-campus house fire at Ohio State University. No ionization alarms sounded; five college students died. Dean works fervently with Doug Turnbull who lost his daughter in a 2005 Miami of Ohio University off-campus house fire. 17 ionizations did not respond in time... three women died. Dean and Doug travel throughout the U.S. educating citizens and fire personnel regarding the dangers of ionization alarms.

The Defect in Smoke Alarms

By Richard H. Taylor

TMZ Lawyers

Personal Injury

The Defect in Smoke Alarms

by Richard H. Taylor

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The Defect in Smoke Alarms

Do you have a smoke alarm in your home? Most likely you do. Is it a photoelectric or an ionization smoke alarm? If you are like an overwhelming majority of Americans you have an ionization smoke alarm, but did not know there were two types of smoke alarms. You're also likely to be among the millions of consumers who believe a smoke alarm will detect smoke and sound if smoke is present. Think again!

If you have a fire, then it matters a great deal whether you have an ionization or photoelectric alarm. If you have a slow smoldering fire, then there is a good chance your ionization fire alarm may not sound, or may sound too late for you and your family to get out of the house alive. Most people do not know that ionization smoke alarms have this hidden defect, but the manufacturers have known for decades. After you read this article, go look at your smoke alarm and see if it is an ionization or photoelectric. If it is an ionization, install a photoelectric also, or a combination photoelectric/ionization smoke alarm. It may save your life and the lives of your family.

BRIEF HISTORY OF SMOKE ALARMS

Around 1970, battery powered smoke alarms were first introduced in America. FEMA indicated that by 1991, 81% of American homes had at least one smoke detector. Current statistics from the National Fire Protection Association put the figure at approximately 96%. The Department of Homeland Security determined that from 2001 through 2004 that there are an estimated 402,500 fires reported in residential structures. These fires cause an average of 3055 fatalities, 14, 475 injures and $5.93 billion dollars in property loss. Alarms were present in approximately 60% of the fatal residential structural fires. Of those fatal fires with an alarm present, the detector operated 39% of the time. That is, these statistics indicate that smoke alarms were present and operated in 23% of fatal residential structure fires. The Homeland Security report went on to state that "fatal residential fires with working smoke alarms tend to occur in the late evenings and early morning hours when most individuals are sleeping." One could conclude that these fire fatalities with working smoke detectors is a result of the defect in ionization smoke alarms.

PHOTOELECTRIC V. IONIZATION

There are two primary types of smoke alarm sensing technologies: photoelectric and ionization. A photoelectric smoke alarm is best for detecting slow smoldering fires. Slow smoldering fires typically involve lots of smoke and little or no flames at the initial stage. For example, a couch may smolder and billow plumes of toxic smoke for a long period of time before developing into a flaming fire. Slow smoldering fires typically occur when people are asleep and are generally responsible for more deaths than fast flaming fires. Photoelectric smoke alarms cost approximately $15.00, but represent less than 5% of all smoke alarms sold in America. Many experts recommend a photoelectric smoke alarm or a photoelectric/ionization combination. The manufacturers recommend that you have both an ionization and photoelectric, but a vast majority of people do not even know there are two technologies.

The ionization smoke alarm is best for detecting fast flaming fires where there is less smoke. In fact, ionization detectors should be called "fire alarms" not smoke detectors because they are designed to detect flames and often do not detect smoke only. Ionization smoke alarms cost approximately $10.00 and represent approximately 95% of alarms sold in America. The ionization smoke alarm may not respond at all to a slow smoldering fire even when a room is completely filled with smoke. If an ionization smoke alarm sounds in a slow smoldering fire, it may take up to **15-30 minutes longer** for it to sound when compared to a photoelectric. Gary Lederer, a Senior Vice President for smoke alarm manufacturer BRK, appeared on the National T.V. program 20/20 in May 1996 where he was questioned about a 15 minute delay in sounding:

Gary Lederer: The photoelectric will sound an alarm sooner than an ionization, but both will sound an alarm in sufficient time to allow you to evacuate the building.

Arnold Diaz: How much sooner would the

photoelectric sound the alarm in a slow, smoldering smoke fire?

Gary Lederer: Fifteen minutes prior to the ionization detector.

Arnold Diaz: Well, I want that extra 15 minutes to go wake up other members of my family, to go make sure everybody's safe, to herd them outside.

Gary Lederer: We, we have the answer for you. We have a combination unit that has both detection principals in one unit.

There is an abundance of technical literature showing that ionization smoke alarms have a substantial delay in sounding when compared to a photoelectric in a slow smoldering fire. Experts for the manufacturers admit this delay. Surprisingly, the in-house engineers and executives at the major smoke alarm manufacturers, such as Mr. Lederer, admit this fact also. At the same time, all the major smoke alarm manufacturers promote the idea that "every second counts" in a fire.

The ionization chamber in ionization smoke alarms is basically the same in all ionization smoke alarms sold in America. The technology for the ionization sensing chamber has not changed in over 30 years. The defect associated with ionization smoke alarms has been the subject of several investigative news programs in this country and others, but nothing has been done to correct the defect. Fire expert and Boston Deputy Fire Chief Jay Fleming believes the defective ionization alarm has claimed the lives of more than 10,000 in house fires over the past few decades. Despite all this publicity and investigation, the smoke alarm manufacturers continue to sell ionization smoke alarms at an alarming rate and have chosen not to inform or warn the purchasing public about the defect.

WHAT DO THE SMOKE ALARM MANUFACTURERS HAVE TO SAY?

There are two major smoke alarm manufacturers in America: BRK Electronics , Inc. (BRK) and Walter Kidde Portable, Inc. (Kidde). BRK at one time controlled the smoke alarm market, but Kidde, a subsidiary of United Technologies (NYSE:UTX) now has the largest market share. Kidde is now the major manufacturer and seller of ionization smoke alarms in America. The manufacturers defend these cases with the same old song and dance: Underwriters Laboratories (UL) tested and certified the smoke alarms. How can they be defective? They also point to the "government studies" they believe supports their conduct.

UL's Standard 217 for smoke alarms was promulgated approximately 30 years ago. The ionization smoke alarms do pass the UL 217 test and all smoke alarms sold in America do have the UL certification emblem on them. The UL 217 Standard is, of course, a minimum performance Standard promulgated by the "industry" itself.

The ionization smoke alarms are subjected to the numerous UL laboratory tests, including the UL 217 smoke box test. However, the UL smoke box test is the only UL test relevant to a slow smoldering fire. The alarm is placed in a test chamber and a cotton wick is ignited. The cotton wick slowly burns and smolders until the smoke becomes thick enough (obscuration rate) for the ionization smoke alarm to sound. If the smoke alarm sounds before a 10% obscuration rate is reached, then the alarm passes and the smoke alarm gets the UL "stamp of approval." The problem with the test is that it is outdated and does not represent fires in the real world. The test procedures and certification protocol have not undergone any significant changes during the 30 years since their inception. The minor changes in the UL 217 test have been a change in the type of material burned and a change in the obscuration level. Both changes conveniently resulted in a test protocol that was more accommodating to the ionization alarm.

When the UL 217 test was promulgated in the 1970's, most homes had furniture made of cotton. Today's homes contain very little cotton; instead, most homes now contain furniture made of materials such as polyurethane. Polyurethane is an oil-based product that gives off huge amounts of smoke and deadly gases such as carbon monoxide and hydrogen cyanide. The deadly gases emitted by polyurethane fires and other

modern day building materials can cause unconsciousness and death very quickly. In fact, most people who die in a slow smoldering fire die as a result of smoke inhalation and not thermal injury. The UL 217 test does not test smoke alarms using modern-day products. We ask the Senior Product Engineer at Kidde if the UL test procedure should be questioned in light of the ionization detector's performance in real world fires. He responded:

A: I don't know if I would say it questions them. It may – it may say that maybe other material could be tested. And as I said, that's a project that's in process right now.

Underwriting Laboratories knows about the problem with ionization smoke alarms. In January 2000, our law firm presented Paul Patty, an UL representative on the UL 217 committee, with over 100 consumer complaints lodged against BRK concerning failures with the ionization smoke alarms. He basically said they may have been discussed in various UL meetings and it would be reasonable and prudent to investigate them. That was almost ten (10) years ago. However, a review of UL 217 minutes clearly reveal that UL and the manufacturers have known about and have discussed this defect for well over ten to twenty (10-20) years.

Underwriting Laboratories is, so to speak, "in bed" with the smoke alarm manufacturers. UL is a non-profit organization; but, UL's funding comes from the manufacturers whose products UL tests. The majority of voting members of the UL 217 committee consist of representatives from the smoke alarm industry, consultants paid by the manufacturers, and UL employees. Have you ever heard the term "the fox guarding the hen house?" The UL Standards will not change unless or until the smoke alarm manufacturers are forced to change by jury verdicts or legislation.

The smoke detector manufacturers often times rely on government studies to defend these cases. One of their favorite studies is the National Institute of Standards and Technology (**NIST**) report dated February 2008. The abstract to this study and one of the conclusions provides:

Smoke alarms of either the ionization type or the photoelectric type consistently provide time for the occupants to escape from **most** residential fires, although in some cases the escape time provided can be short. Consistent with prior findings, ionization type alarms provide somewhat better response to flaming fires than photoelectric alarms, and **photoelectric alarms provide (often) considerably faster response to smoldering fires than ionization type alarms.**

This conclusion is very carefully worded. Note that the study concludes that the smoke alarms provide time for occupants to escape from **MOST** residential fires. A smoke alarm, like a seatbelt in a car, is a life safety product. How would a person react if the seatbelt contained a sticker that stated "this seatbelt will hold you **most** of the time?" Stated differently, perhaps the smoke detector industry should put a warning on its smoke detector that states "this smoke alarm will sound **most** of the time if there is a fire." Unfortunately, that would be a true statement because the last time we checked "most" can simply mean 51% of the time.

Nonetheless, the study specifically concludes that "photoelectric alarms provide (often) considerably faster response to smoldering fires than ionization type alarms." Exactly the point. When one reads the data contained in this study and in other studies the term "considerably faster" shows that the photoelectric is anywhere from 15-30 minutes quicker than an ionization in slow smoldering fires. In other words, it will take an ionization approximately 15 to 30 minutes longer to sound in a slow smoldering fire when compared to a photoelectric. As Arnold Diaz stated on 20/20 in 1996, "Well, I want that extra 15 minutes to wake up other members of my family, to go make sure every body is safe, to herd them outside."

CONSUMER COMPLAINTS

We know how ionization smoke alarms perform in the UL 217 laboratory smoke box test. They pass with flying colors. But, how do the smoke alarms perform in real-world fires?

When our law firm litigates with a smoke alarm manufacturer, we request complaints from

consumers who write or call the manufacturer complaining about the performance of ionization smoke alarms in their homes. The smoke alarm manufacturers do not like producing these consumer complaints, so trial judges typically have to compel the smoke alarm manufacturers to produce them. When we eventually get the consumer complaints, we contact some of the consumers and ask that they give a video deposition. The testimony of these consumers can be truly amazing. Some of these videos can be viewed on our website: **www.TaylorMartino.com**

The consumer complaints tell us two significant things. First, the consumer complaints tell us how the smoke alarms perform in real-world. The consumer complaints and the testimony of the consumers clearly show that ionization smoke detectors do not perform as they perform in the UL 217 laboratory smoke box. For example, one consumer testified under oath that he had 3 fully powered ionization smoke alarms in his home when he went to bed. He awoke to a house full of smoke and none of the alarms had sounded. He was alarmed that they did not sound and he sent all 3 smoke alarms back to the manufacturer along with a complaint letter. The manufacturer placed the 3 smoke alarms in a UL 217 smoke box and they passed the test. The manufacturer sent a standard form letter explaining why his smoke alarms did not sound. The response letter from the manufacturer stated that smoke did not reach the alarm (not true according to the sworn testimony) or it was cold smoke in the house (whatever that is.)

Secondly, the consumer complaints and documents tell us that the smoke alarm manufacturers know how their ionization smoke alarms perform in real-world . In one case, over 370 consumer complaints were produced, and in another case over 100 consumer complaints were produced. Our law firm has taken the depositions of the representatives of each major smoke alarm manufacturer whose responsibility is to monitor consumer complaints. The testimony of these representatives boggles the mind. For example, a corporate representative for Kidde testified as follows:

Q. ...well, first of all, you agree with me that Kidde knows about this phenomenon, being, your house will fill with smoke and your ionization won't sound, it knows about that, didn't it?

A. Apparently, yes.

Q. Okay. And it's apparent because they even have people calling and had to make it a frequently asked question and to have a response to it, right?

A. Yes.

Q. Okay. Yet that is not communicated to the folks like the Spencer family when they went to buy their smoke detectors, is it?

A. It is not communicated on the packaging – that question is not communicated on the packaging.

Q. And even though you agree, as 23 years with this company, that it's a safety concern, it's not communicated, is it?

A. No, it's not on the packaging.

Similarly, a BRK representative testified as follows:

Q. . . . Has it to this day ever caused you any concern that on average you receive a call a week from folks saying, this smoke detector is not responding to smoke?

A. Well, I'm not sure what you mean by concern. We certainly took any call or inquiry like that seriously so that we would make arrangements to get the detector replaced and in-house for testing.

Q. Well, by concern I mean do you ever kind of worry about it or lay awake in bed going hmm, that sure is a lot of calls we're getting in on these smoke detectors that people rely on to save their life?

A. Well, if the detectors weren't working then I would be concerned.

* * * * *

Q. And you [have] received hundreds of complaints of people saying this smoke detector didn't respond to smoke?

A. We have.

The bottom line is that the smoke alarm manufacturers know ionization smoke alarms are defective, but they do not tell people.

DO YOU HAVE A SMOKE ALARM CASE?

If you have a case involving a fire and there is a death or substantial injury, then you should consider a potential smoke alarm case. The first order of business is to secure the scene and locate all smoke alarms in the structure. The smoke alarms must be preserved. If the smoke alarm is still on the wall or ceiling, then remove a section of the wall or ceiling with the smoke alarm intact. The smoke alarm can be x-rayed to determine if the battery is still intact and properly positioned. The smoke alarm must be inspected by a smoke alarm expert and a battery expert if there is an issue with the battery. Failure to maintain the integrity of the smoke alarm and the battery during removal may result in spoliation of evidence issues. If the manufacturer can be identified prior to removal, then it is a good idea to contact the manufacturer and place it on notice of your intentions to remove the detector.

People familiar with the house should be questioned about the number and location of the smoke alarms and when and where they were purchased. Determine the make and model and purchase an exemplar. You should determine if the smoke alarm sounded or sounded late during the fire. Immediately interview any survivors, neighbors, and first responders to determine if they heard a smoke alarm sound. If the smoke alarm is powered, but did not sound in the presence of smoke, then you most likely have a defective ionization smoke alarm. If your investigation reveals that the smoke alarm did sound, then determine at what point in the fire it sounded. Remember that ionization smoke alarms have a significant delay in sounding. Oftentimes, the sleeping occupant needs only 30 more seconds to get out of the burning structure and a smoke alarm sounding 15-30 minutes late could certainly be the cause of their inability to escape.

Another favorite defense of the manufacturers is the battery. The defense will look for evidence that there was no battery in the smoke alarm, it had been disconnected or the battery was old. Ionization smoke alarms are notorious for nuisance alarms during cooking. Oftentimes, people disconnect their smoke alarm battery and fail to reconnect it. Therefore, your investigation should immediately focus on the battery itself and any witnesses who have knowledge about the maintenance of the smoke detector, especially any testing or replacement of the battery.

Smoke alarms are designed to alert people to a fire. Most smoke alarm cases involve situations where the family is asleep, a fire breaks out, and the smoke alarm does not sound or delays in sounding during the early stages. If the fire occurs when people inside the house are awake and aware of the fire, then there may be no proximate cause between the failure of a smoke alarm and any resulting death or injury. Therefore, determine where everyone was in the house at the time of the fire and what they were doing. It is very important to establish a detailed time line with regard to the progression of the fire and the activities of the people inside the house. Many experts are needed in these product liability cases.

CAUSES OF ACTION

The causes of action against a smoke alarm manufacturer are well known to most lawyers. You allege product liability, negligence and wantonness. However, you should also consider breach of warranty and failure to warn.

One of the best theories of recovery against a smoke alarm manufacturer is failure to warn. It can be easily proven that the smoke alarm manufacturer knows that the ionization smoke alarm has a history of failure and defect. The

manufacturer will admit the delay in sounding and will have to admit its knowledge of the consumer complaints. However, despite this knowledge, the manufacturers do not warn about the hazard. Purchase an ionization smoke alarm at a local retail store and read the package front and back before opening it. Typically, the only information pertaining to the limitation (defect) of the smoke alarm is wording such as:

"Kidde recommends for maximum protection that both ionization and photoelectric smoke alarms be installed. Ionization technology is faster at detecting fast flaming fires that give off little smoke. Photoelectric technology is faster at responding to slow smoldering, smoky fires."

There is no warning on the package telling the purchaser how much faster the photoelectric is at detecting a slow smoldering fire. The manufacturer knows the ionization alarm has a 15-30 minute delay in sounding when compared to the photoelectric. However, this is not revealed. In fact, the smoke alarm manufacturers have testified that they do not warn about the substantial delay in sounding or the risk of not sounding. They must admit this because there are no "warnings" concerning this defect in the packaging or on the alarm.

Our firm conducted a statistically valid marketing survey of people in the State of Alabama. The marketing study revealed, among other things, the following: 95% did not know the difference between ionization and photoelectric, and 60% did not purchase their smoke alarm.

A similar survey can be conducted in your case. It costs very little and can be the foundation of your failure to warn theory. The survey should show that approximately 95% of the purchasing public does not know the difference between ionization and photoelectric. When we conduct focus groups and voir dire in these type cases, we have never had a person say they knew the difference between ionization and photoelectric. In fact, we have never had a person say they even knew there were two different types of smoke alarm technology. This alone tells you the manufacturers have done a very poor job educating and informing, much less warning, the public about the "defect." It is the manufacturer's responsibility to educate the public on any hazards associated with a smoke alarm which should at the very least, include an explanation of the limitations of the ionization smoke alarm. Obviously, the manufacturers have not done this since few people know the difference. Further, even though the manufacturers recommend both ionization and photoelectric smoke alarms for maximum safety, they do not adequately explain the reason. Plus, the manufacturers know people do not follow this "safety recommendation" to have both technologies because 95% of sales are ionization. Very few people (about 2.5%) have a photoelectric.

Another important fact revealed in the marketing study is that 60% of people do not purchase their smoke alarm. Did you purchase yours? Most people rent an apartment or move into a home where the smoke alarms are already present. Therefore, the plaintiff and the members of the plaintiff's family never read or have the opportunity to read the package inserts or the owner's manual. They only see the smoke alarm itself attached to the wall or ceiling. The smoke alarm itself is completely void of any warnings. Therefore, one should focus on the total lack of warnings on the smoke alarm itself. There is a complete and utter failure to inform or warn on the smoke alarm itself.

Most smoke alarms have a 5 -10 year express warranty and may not adequately exclude the implied warranty of merchantability. A warranty cause of action is important in states such as Alabama where only punitive damages can be awarded in a wrongful death case. If breach of warranty is alleged, then the plaintiffs are entitled to recover compensatory damages incurred before death. This would include mental anguish and pain and suffering while attempting to get out of the house during the course of the fire. These damages can be very emotional for a jury. Also, in many States there are only limited defenses to a breach of warranty claim.

HOW CAN WE GET IONIZATION SMOKE ALARMS OFF THE MARKET?

At least three states have "outlawed" ionization-only smoke alarms in new construction. Massachusetts, Vermont and Iowa passed laws that do not allow ionization-only smoke alarms in new construction. A similar bill should soon be enacted in Tennessee. Unfortunately, these laws were initiated before the state legislatures by families who lost loved ones in fires where ionization smoke alarms did not sound or delayed in sounding. We should not wait for more deaths before we bring the issue before the state legislatures. The laws that were passed by Massachusetts, Vermont and Iowa can be found on our website.

Our law firm recently reached a confidential settlement in the Spencer v Kidde in Mobile, Alabama against a major smoke alarm manufacturer. In that case, a single mother age 32, and her two minor children ages 11 and 14, died when their ionization smoke alarm did not sound during a slow smoldering fire. The Spencer family and our law firm established a foundation called Smoke Alarm Awareness Foundation, or SAAF (**www.SAAF.com**). The purpose of the foundation is to make the public aware of the defects in ionization smoke alarms and to introduce a law in the Alabama Legislature similar to the laws in Massachusetts, Vermont and Iowa. It appears that the only way to get ionization smoke detectors off the market is to have legislation passed or for juries to hold the manufacturers accountable. Hopefully, you can help by introducing legislation in your State or by asking a jury to hold the manufacturers accountable.

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THE LIES THAT KILLED TEN THOUSAND CHILDREN

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THE GREAT BULK OF THE FIRE DEATHS AND INJURIES ARE DUE TO CALCULATED, PLANNED, DELIBERATE UNETHICAL OPERATIONS WITHIN THE FIRE CODE SYSTEM OF THE UNITED STATES. YES, FIRE CODE CORRUPTION IS THE FUNDAMENTAL CAUSE OF NEARLY ALL FIRE DEATHS TODAY.

The primary reason why fires kill in the home is because smoldering fires, which can turn into hot flaming fires, fill a room with deadly toxic fumes. A fast-growing flaming fire can grow quickly from a smoldering fire to a killing -size completely undetected by those outside that fire room. Fire within one room can grow quietly to what we call a "Room Flashover" condition, at which point every combustible within the room flashes. Then, because the "explosion" in fire size creates an overpressure condition within the fire room, hot combustion gases will pour out of that room at temperatures of more than five times the temperature of boiling water. The smoke will likely be thick, jet black and blinding. The toxic combustion gases including carbon monoxide can drop a grown man before he reaches an exit door. These fire gases will be so hot that they can literally peel flesh off the bones. It is rare when a body is carried out of a home that does not show some major heat damage.

There is an easy solution to fire deaths within homes. It is to install reliable fire detectors of the correct type so that when a fire is still smoldering and easy to snuff out, or to escape from, an emergency warning will sound. Fire is like a tiger cub. When it is small it is not yet a threat to life and it is easy to kill. So, the primary reason

why fire is deadly (especially to children) is because ineffective ionization smoke detectors, with failure rates exceeding 50 percent, have been marketed to more than 90% of American homes.

NEARLY ALL FIRE DEATHS ARE THE RESULT OF FAILURE TO RECEIVE A TIMELY WARNING WHILE THERE IS STILL TIME TO ESCAPE. THE DECEPTIVEMARKETING OF UNRELIABLE IONIZATION "SMOKE" DETECTORS IS THE CAUSE OF THE DELAYED WARNINGS.

It is difficult to believe that code dishonesty could be the root cause of most fire deaths. But it's true and the proofs are now available and posted on the Internet. Indeed, live fire tests, conducted within real buildings, have confirmed that home fire detectors of the ionization type, marketed for more than four decades as a "smoke" detector, are so ineffective and unreliable, that they endanger life. By promoting inadequate and often deadly smoke detectors for homes, real and reliable detection devices that should have saved lives were not readily available to the public.

The ionization-type "smoke" detector was proven to be ineffective and a threat to human life more than 25 years ago. I submit the following quotes to confirm this.

U.S. Fire Administration: "We put 50 million smoke detectors in buildings in America in a two year period and our fire loss and death rate goes up. We're having a little trouble explaining these things", Gordon Vickery, former head of the U.S. Fire Administration. Source: Fire engineering magazine, September 1980.

Fire Chief Magazine: "Smoke detectors were an unknown term to 99 percent of the population ten years ago. Today millions of family dwellings have them, yet there is no reduction in loss of life from fire. The paradox has not been explained" Source: Fire Chief Magazine, January 1980.

Fire Chief, City of Los Angeles: "A startling fact has been disclosed . . . John C. Gerard, Chief of Los Angeles Fire Department cited national statistics showing battery powered smoke detectors have a 50 to 80 percent failure rate" Source: Fire Control Direst, Vol. 6, No. 10.

Future Products

Solar Road Studs

Illuminated Glass Blocks

Industry Information

National Fire Protection Association (NFPA):
"Residential fire death rate increases 20 percent over 1984 residential death rate with over 100 million smoke detectors installed in American Homes." Source: NFPA Fire Journal, November 1986, page 44.

International Association of Fire Chiefs: "The subcommittee is concerned with some smoke detector advertisements. The subcommittee felt that some advertising claims were too strong and, in some cases, deceptive and misleading to the public, resulting in a false sense of security." "A full system of multiple photoelectric smoke detectors, supported by heat detectors, affords the best protection for a family against the threat of fire." Source: Residential Smoke Alarm Report, published by the International Association of Fire Chiefs, September, 1980.

It all began during the early 1960s when I was named chairman of four different fire detection codes of the National Fire Protection Association. The NFPA creates nearly all of the fire codes that are enforced by your local fire department. When I assumed responsibility for the fire detection codes I realized that homes (where 95 percent of all fire deaths involving building fires occur) were totally devoid of fire warning equipment. So, I immediately initiated the writing of a fire detection code for dwellings. With the best and most knowledgeable people in the field, we had a new code up for adoption at the 1966 NFPA National Convention. That code required heat detectors throughout a home and smoke detectors wherever there was a serious risk of a smoldering fire. Generally this meant bedrooms and where upholstered furniture would be subject to a smoldering fire. Heat detectors were the superior and near-100% reliable device for warning of the very dangerous flaming fire. Somewhere the industry got off track and replaced heat sensing with ionization sensing. A smoldering fire can produce smoke and toxic gases without creating significant heat, so ionization smoke detectors were also recommended, however they are ineffective in detecting the fine smoke particles of a smoldering fire. Now that exhaustive tests have proven that ionization detectors simply do not recognize smoldering fires in a timely fashion, it has become apparent that the only combi-units that function in a timely fashion, in all fire conditions, contain both photoelectric and heat sensors. Photoelectric sensors can detect the fine particles of a

smoldering fire and heat sensors can detect fast flaming fires.

The newly created NFPA Standard No. 74 defined a reliable fire detection system for homes for the first time ever. As the initiator of this code, I believed that eventually fire deaths would be nearly eliminated. If promptly warned of a fire at a very early stage, the occupants would either quickly snuff out the still-tiny fire (before outside help was needed), or leave the home safely. However, although I did not realize it at the time, by opening a new potential multi-billion dollar market for home fire detectors, I brought the wolves and their corrupt allies into the game. The ghouls, who envisioned profits where I saw lives at risk, decided they could capture that new huge home market for fire detectors.

Devious and clever business people began peddling a device containing the radioactive material Americium 241, which emits the nucleus of the helium atom (an Alpha particle) **37,000 times per second.** This radiation causes an electrical current to flow across the detection chamber. When an enormous number of near atomic sized particles (say billions within a cubic inch) enter the detection chamber the current is diminished and an alarm sounds. The type of particulate that will cause the device to sound can be produced by toasting bread, overheated roasts and a steamy shower. Unfortunately real (visible) smoke will not cause the device to sound because smoke consists of combustion particles too large and too few to interfere with the current flow. However, the clever and unscrupulous promoters created a specific test that produced the "right particulate" to make it sound and then advertised that it would detect every type of fire "before you can see the smoke or flames". The rigged tests and false performance claims were backed by pseudo science. These phony performance claims created the idea that a wonderful new solution to fire detection had been invented. But, it was all an incredible fraud. The manufacturers conned the fire chiefs and then enlisted firefighters to sell the things during their numerous "non-duty" days.

Nearly all fire department officials are firefighters who rose through the ranks. They are not engineers, scientists or technically sophisticated people. Their "expertise" is in the form of codes and standards to be

enforced. The NFPA creates nearly all the codes that fire officials enforce. The committee members that create the codes consist mainly of representatives of businesses that make money from the fire problem. Underwriters' Laboratories tests and "certifies" the approved equipment such as fire hose, fire pumps, extinguishers, building materials etc. So, a fire inspector will do two things, interpret the NFPA code and confirm that the system or device is "UL Listed". If it meets code and is UL "certified", then it is OK to the fire inspector and plan reviewer. That is how "fire safety" is applied in America.

The public believes that UL and NFPA are humanitarian operations saving us from the fire peril. Actually, they are businesses selling services and they need money to survive. The businesses that profit from the fire protection industry deliver the necessary funding to the NFPA and UL. UL employs inadequate and even fallacious testing to "certify" the efficacy of the ionization sensing devices that now "protect" our children.

The UL Label on that so called "smoke" detector convinced the fire chiefs that the device was reliable. Of course UL also profited from the marketing of the so-called smoke detectors. And, for years the con men selling the ineffective smoke detectors bought full page ads within the NFPA ***Fire Journal.*** It would be no exaggeration to say that UL and NFPA got into bed with the manufacturers and helped deceive both the fire chiefs and the public.

The residential fire detection code that I pushed through to adoption mainly relied on the extremely reliable heat detectors to warn of the most dangerous type of fire, the fast growing flaming fire. The NFPA offered the chairmanship of the code I created to an administrative level fire engineer within the federal government (the National Bureau of Standards - NBS). There was a proviso, however. That federal engineering manager agreed to rewrite the NFPA 74 code to essentially kick the heat detectors out of the code while opening the door wide for smoke detectors. He proceeded to do just that. Then, later, he was assigned to be the federal monitor of a fire test program called the Dunes Tests. This test program, beginning in 1974, involved 76 live fire tests in real homes. In the event that the Dunes Tests revealed that the ionization device was as defective as it was, there would have been major repercussions. By 1974

thousands of deaths and injuries had already occurred within ionization detector protected homes. Since UL had "approved" the defective device, UL people involved might have faced criminal charges and jail sentences for negligence. However, three of the four test engineers assigned to the Dunes Tests, including the lead engineer, were UL employees.

The average time for that "super fast" ionization detector to respond to smoldering fires (during Phase 1 of the tests) was 65.8 minutes. The ionization device had 162 chances to operate during the smoldering fire tests. Exactly zero devices operated within 10 minutes of the fire initiation. Only 28 times out of 162 chances did the device operate within a half hour. The device also operated erratically during flaming fire tests. As for testing heat detectors, during 75 of the 76 fire tests, either the engineers did not install heat detectors in the fire rooms or, when installed, the fires were so small that the ceiling temperatures failed to reach the operating temperature of the detectors (135 degrees F). Exactly one test - only one - was conducted with the heat detectors in the fire room, with a fire that created a ceiling temperature above 135 degrees F during the first ten minutes of ignition. The heat detector operated perfectly during that one "slow-growth" flaming fire. Talk about rigging a test program! I have to admit the federal and UL engineers were geniuses at the game. When I received that incredibly corrupt Dunes Tests report, I analyzed it and then wrote my 1976 report, ***The Smoke Detector Fraud.*** Then I had 3000 copies printed and sent them to fire engineers and fire officials across the country.

My first exposé of this fraud plus many additional reports, letters and talks before fire officials finally created concerns about the ionization device. That's when the fire officials began to question the Dunes Report and the efficacy of the device being sold (see the above quotes). During the late 1970s the fire officials in California, referred to as the Cal-Chiefs, realized that the ionization detector had serious flaws. So, the Los Angeles Fire Department, with help from the IAFC, conducted a comprehensive series of fire tests. These Cal-Chiefs tests put the lie to the Dunes Tests. The fire chiefs concluded that the ionization device had been falsely advertised, that it would have a 50 to 80 percent failure rate in the field and that it was not fit to be

installed to protect life in homes. But the chiefs were no match for the scientists, engineers and the ghouls who controlled the codes and the research money. Pressure from the NBS (later named the National Institute of Standards and Technology - NIST) forced the L.A. Fire Department to bury that report. The Cal-Chiefs Test Report of the late 1970s was "buried", never to surface again.

The ionization type smoke detector was first marketed during the mid 1960s. By the time the Cal-Chiefs tests were run in 1978, the number of deaths and injuries due to "failures to warn" were already into the tens of thousands. Most fire officials, the NFPA, UL and the federal agencies, including people within the Consumer Product Safety Commission (CPSC), were promoting the device. Many bureaucrats within government realized that if the truth surfaced they could be in deep trouble. The campaign to hide the facts intensified. For many years I was a lone voice crying in the wilderness. To buck the fire regulatory system can be very damaging to one's career - and bankbook. So, it was prudent to go with the flow. But I never lost sight of the fact that kids were being burned by the thousands. So I persevered.

Finally two men outside of the United States, Adrian Butler in Australia and Karl Westwell in New Zealand, read some of my many reports. My reports confirmed what they were already concluding overseas. Since the regulatory ghouls that controlled the ball game in the U.S. had little if any power over there, these men were able to gain new and honest testing of that unreliable device in Australia. The results shocked and startled the Australian Standards Committee members there. Based on the new and honest testing, the fire officials in Australia published a paper confirming that the ionization device is a threat to life. So, after more than four decades of burning the kids while deceiving the public relative to the fundamental cause of the "failures to warn", the truth is finally emerging. Now similar tests are being conducted in the U.S. Hopefully, the ghouls who profited, as the kids were burned alive, will finally be made to answer for their misdeeds.

Please visit **www.WTHR.com,** which is the TV station web site in Indianapolis, Indiana. Investigative reporter Bob Segal and the State Fire Marshal of Indiana, Roger Johnson, ran fire tests that everyone who respects life

should see. Jennifer Kraus of News Channel 5 in Nashville, TN has interviewed fire survivors who lost loved ones when their ionization sensing devices failed to sound. Representatives of the Tennessee State Fire Marshals' office and the State Legislature were astonished at the results of the tests run there. Russell Ashe, Lieutenant on the Barre City, Vermont Fire Department helped carry four dead children and their mother out of a home. Now Barre City has its own test results and is alerting the Vermont public to the dangers. Pending legislation in the state of Vermont will ban ionization and require photoelectric smoke detectors in all new construction, and require the retrofitting of photoelectric smoke detectors in all homes being resold.

I'd be remiss if I did not mention Joseph M. Fleming, Deputy Fire Chief of Boston, MA for the many years of his own time and money spent advocating the banning of ionization smoke detectors and replacing them with photoelectric smoke detectors. Chief Fleming feels strongly that combining photoelectric sensors with ionization sensors as a combi-unit does not solve the problems of false alarms and is simply a face saving move on the part of some manufacturers.

The organization within Australia that finally moved the exposé into high gear is the World Fire Safety Foundation (WFSF). There is an enormous amount of factual information relative to this ongoing public endangerment published on its web site. See the information and the fire tests now available and you will immediately become an advocate for recalling those children-killing devices.

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Photoelectric vs Ionisation

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Crusade
Against Fire Deaths, Inc.
Our Goal: Reduce Fire Deaths In the U.S. By 90%

October 11, 1993

Karen Mikkawi
Technical Correspondent
Standards Department
Underwriters Laboratories, Inc.
1655 Scott Blvd.
Santa Clara, CA 95050-4169

Subject: U.L. 217

Dear Ms. Mikkawi:

I have reviewed the U.L. 217 report dated July 13, 1993 and I recommend that it not be adopted by ANSI, but rather that additional testing be added to the standard first.

I find that the current U.L. Standard 217 does not adequately test a smoke detector relative its ability to detect a cigarette caused smoldering fire involving an upholstered chair or sofa in the living room, or bedding in a bedroom. This smoldering type fire is a very insidious type because it often occurs after all are asleep. Such a fire will fill a home with smoke, and a substantial level of carbon monoxide, without operating an ionization type smoke detector.

The smoke box test is not a true test for evaluating the performance of a smoke detector in a real home for reasons which I'll not delve on here, as I believe they are "obvious."

That leaves the "Ponderosa Pine on Hot Plate" test for evaluating the smoke detector's ability to detect a smoldering (cigarette caused) fire in a full scale facility.

This test is dissimilar to a real smoldering fire in a home in at least four important ways:

1. The hot plate temperature (up to 752°F) produces a smoke with both the buoyancy and the "volume" to rise to the ceiling, flow rapidly along the ceiling, and reach and interact with the smoke detector.

2. The character of the smoke will be different. The ionization detector reacts well to the very fine particulates produced under hot (high energy) conditions. In contrast, the ionization detector does not respond well to the large particulates produced by a **very low temperature fire** (cigarette caused smoldering fire).

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3. The cooking of the ponderosa pine may not be typical of many real fires in real homes. I believe ponderosa pine is **not** used in construction.

4. The ambient temperature at the ceiling may be 5 to 10 degrees higher than the temperature at the floor of a room. Therefore, when **cool** smoke attempts to rise to the ceiling, it may bump against **hotter** air, and **stratify below the ceiling level detector.** Cool smoke may never reach the detector.

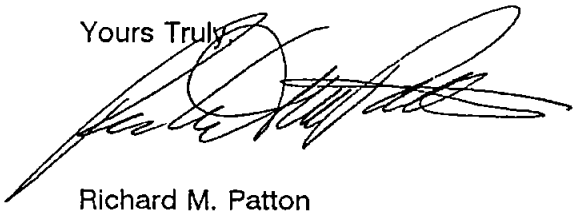
Accordingly, I recommend that the test program be enlarged so as to test smoke detectors against **real smoldering fires** under **real size room conditions.**

Of course, this will slow down the testing as such a test may require several hours. But, some testing at the laboratory takes weeks or months. Please keep in mind that what is being tested is the **ability of a device to detect the products from any and all types of fires that may occur in the home, so as to prevent loss of human life.**

Fire is a life and death matter, therefore, it is essential to conduct **realistic** testing of smoke detectors relative the true cigarette caused smoldering fire. This fire type is very common in homes, and it can be a very dangerous type fire. I enclose an extract from a 1963 study by Los Angeles Fire Department which claims that smoldering fires represent 75% of all home fires. I suspect this statistic (75%) is wrong, but even so it does imply that a smoldering type fire should not be omitted from the tests.

I go further. Having recently reviewed the U.L. testing procedures, and having discovered that the testing does not adequately evaluate the performance of the smoke detector relative the slow smoldering and insidious cigarette caused ignition, I suggest that an advisory be issued to all fire officials across the nation, so as to alert them to this potential "hole" in the smoke detector's performance profile. I trust these suggestions will prove useful to you. As a concerned fire protection engineer I am anxiously awaiting your reply.

Yours Truly,



Richard M. Patton
President
Registered Fire Protection Engineer

RMP/sab

Enc: 1. Los Angeles Fire Department Test
2. Engineering Analysis of the Indiana Dunes Tests

Additional reading re: Ion vs. Photo

Produced by: The World Fire Safety Foundation

the CAN report

Recommending, selling or installing ionization smoke alarms, a Criminal Act of Negligence?

The CAN Report - version 2.1 | Published: 19Feb07 - Updated: 01Feb10

The CAN Report is a 'living document': any aspect of this report may be updated at any time.
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THE AUSTRALIAN BUILDING CODES BOARD

21 February, 2007

Attn: Recipients - Australia & New Zealand (pages 14~16)
Re: **Fire Chiefs Plead for Help in Reducing Fire Fatalities** (page 3)

Dear [Sir/Madam]

I am writing on behalf of the World Fire Safety Foundation to invite you to join a growing team dedicated to reducing fire fatalities.

The Australian Building Codes Board (ABCB) has recently chosen to block the adoption of a proposed amendment to Australian Standard 3786 to rectify the inadequacies of acceptance criteria for ionization smoke alarms, the type of smoke alarm currently installed in the vast majority of Australian and New Zealand homes.

Recent scientific research has confirmed that ionization alarms do not safely detect smouldering fires, the type of fire that commonly kills. On 01 June 2006, the Australasian Fire Authorities Council (AFAC), as the peak representative body of all Australian and New Zealand Fire Brigades, issued a position statement that declared: **"... all residential accommodation be fitted with photoelectric smoke alarms."** [1] This world precedent and laudable position is supported by the Australian Standards Fire Protection Committee FP2, the Australian Consumers' Association, the Fire Protection Association Australia, the New Zealand Consumers' Institute and the New Zealand Safety Council.

When confronted with the evidence regarding the very serious inadequacies and unacceptable failure rate of ionization alarms, all these leading authorities had the courage and vision to reverse earlier decisions and place the public's interest above all other considerations by unequivocally recommending photoelectric smoke alarms.

We all have the moral imperative to alert the public. Now the ABCB has a golden opportunity to follow these industry experts and include FP2's amendment in the Building Code of Australia. No one wants this needless loss of life to continue. You could be held accountable for subsequent injuries or deaths, if these were avoidable, just as easily as you could appropriately be credited for saving them.

The attached report sets out the key reasons why the ABCB should reconsider its position and facilitate the appropriate and responsible choice in light of conclusive research. This reversal, which we are confident will be the ABCB's response to the information contained herein, will be honoured as a major contribution to the aim that galvanises our Foundation, the authorities previously mentioned and the ABCB - the safety of our fellow citizens in their own homes.

We respectfully request the Board to respond to this communication (to the Australian or New Zealand address below) prior to our press release on Wednesday 21 March 2007 which will contain a list of those who actively support our position.

In the 1985 'Lawyer's Alert' magazine, US Lawyer Edward M Swartz said:
"There is something very wrong with selling [ionization] smoke detectors that don't work, that lull consumers into a false sense of security, and that end up taking the very lives that they were intended to save, if that happens the people who are responsible should be made to pay..." [2]

It would be beneficial to our common endeavour towards ever greater Fire Safety if the WFSF were able to include you personally, or your organisation, in a list of our supporters. Please contact us if you have any further questions.

Yours Sincerely

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PROJECT SPONSORS OF THE NIST REPORT

(07/2004 Technical Note 1455)

22 February, 2007

Attn: Recipients - USA & Canada (page 16)
Re: **Fire Chiefs Plead for Help in Reducing Fire Fatalities** (page 3)

Dear [Sir/Madam]

I am writing on behalf of the World Fire Safety Foundation to invite you to join a growing team dedicated to reducing fire fatalities.

Your organisation was involved as a Project Sponsor of the 2004 report 'Performance of Home Smoke Alarms' issued by the National Institute of Standards & Technologies (07/2004, Technical Note 1455).[3]

Scientific tests conducted by the Building Research Association of New Zealand were aired on national New Zealand TV in May 2006 and confirmed unequivocally that ionization smoke alarms are inherently dangerous because they do NOT detect smouldering fires in time for occupants to safely escape. This is in direct conflict with the conclusions of the 2004 NIST report which are, in fact, not supported by the data within it. The NIST report has caused substantial delays in the adoption of a critical revision to the Australian Standard for smoke alarms. These delays WILL cost lives.

The World Fire Safety Foundation believes that the NIST Report is effectively a death warrant. The Foundation will seek and encourage victims of this misinformation to instigate actions against individuals or organisations involved with any failure to act with due care and responsibility to rectify this problem.

Chief Joseph Fleming of the Boston Fire Department has spent 16 years analysing international smoke alarm research and has issued objective papers that have been instrumental in prompting the Australian Standards organisation to mandate photoelectric smoke alarms in Australian and New Zealand homes. On page two of this letter Chief Fleming has identified a viable way to significantly reduce US fire fatalities. Entries in the Timeline indicate where NIST and the CPSC have failed to respond to information supplied by Chief Fleming (page 7: 10/2006 and 12/2006).

Consistent with our Australian fire brigades and fire authorities, US fire-fighters have shown courage and integrity by making available live real-world testing of smoke alarms on the internet.[4] These tests adhere to the specifications of the IAFC's 1980 Residential Smoke Alarm report and confirmed the IAFC's 1980 warning that ionization smoke alarms are **"so slow to react in a smouldering fire that lives may be in danger."** In contrast, NIST (falsely) claims that **"ionization smoke alarms continue to provide time for occupants to escape"** However, **NIST Report's conclusions are contradicted by their own data contained within the report** (page 9).

On page 2, Chief Flemings comments **"Of course this requires that the USFA admit that it [photoelectric technology] is superior to ionization technology. An action, which the USFA does not appear willing to take."** However, there is something far more important than the reputations, both individual and corporate, of those within government, consumer organisations and the fire industry - the lives of those they are entrusted to protect. We all have the moral imperative to protect lives by alerting the public of the very real and present danger posed by the ionization smoke alarms supposedly protecting their families. No one wants this needless loss of life to continue. You could be held accountable for subsequent injuries or deaths, if these were avoidable, just as easily as you could appropriately be appropriately credited for saving them.

This report provides "clear evidence of a sufficiently compelling hazard in order to justify a change" and therefore advocates the banning of ionization smoke alarms (or the mandating of photoelectric smoke alarms) even though it may "literally put companies out of business" (page 7, 1999). We believe you will agree that your organisation has a responsibility to petition NIST to rectify their report so its conclusions do not contradict the data contained within it.

On behalf of the World Fire Safety Foundation I shall contact your personal assistant to establishing a mutually-convenient time to discuss this issue with you. It would also be beneficial to our common endeavour towards even greater Fire Safety if the WFSF were able to include you and/or your organisation, in a list of our supporters.

Yours Sincerely

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PROJECT SPONSORS OF THE NIST REPORT

(07/2004 Technical Note 1455)

Extract from a letter to the US Fire Administration by Chief Joseph Fleming (10/2006).
(**Note:** All quotes from Chief Fleming's letter are in bold)


Chief Joseph Fleming

"I have often been cautioned that I should be quiet, "because we do not want the public to lose faith in smoke detectors." This statement implies that lives will be lost if we tell the American public the truth. I think the exact opposite is true ... how many lives have been lost because the American Public was not told the truth?"

In his letter Chief Fleming provided evidence to show that in the US alone:
"The Potential number of lives saved [from 1990 through 2005] **if photoelectric technology** [had been] **used instead of ionization: 11,256."**

Chief Fleming believes that the estimated number of lives potentially saved is conservative. The World Fire Safety Foundation agrees. In addition for each life lost in a house fire, many more are injured or maimed. This pain and suffering could be so easily avoided if the smoke alarms supposedly 'protecting' consumers would sound a timely warning BEFORE fires in their homes becomes dangerous.

Chief Fleming also stated:
"The bad news is that thousands have died who did not need to die. The good news is that I have identified a relatively inexpensive way to reduce fire fatalities in this country (the United States) **by hundreds each year by utilising photoelectric technology to its full advantage. Of course, this requires that the USFA admit that it** [photoelectric technology] **is superior to ionization technology. An action, which the USFA does not appear willing to take. I hope this provides the USFA, the CPSC, NIST, HUD etc, the incentive to honestly investigate the problem and start by objectively reviewing my information and answer all of my questions."**

World Fire Safety Foundation Comments:
In its 'Residential Smoke Alarm Report' (09/1980), the IAFC warned:

"Promotion and advertising [of ionization smoke alarms] is misleading the fire chief and the public ... lives may be in danger."

The IAFC said they **"...can take no other choice but to recommend the installation of photoelectric detectors."** Their advice went unheeded. Twenty-seven years later the IAFC chiefs are still pleading, "...help reduce fire deaths." The World Fire Safety Foundation has evidence that for thirty years NIST, CPSC, USFA and HUD and other organisations and individuals have been aware of the inherent dangers of ionization smoke alarms. It is alleged that people within these organisations have engaged in:
- ignoring, distorting or suppressing evidence,
- manipulating research data,
- continually calling for more and more tests to maintain the status quo.

These actions evade responsibility for past failures to discharge legal and moral obligations to the American public.

This must stop!

There is **"clear evidence of a sufficiently overwhelming hazard to justify a change."** (page 7, 1999) It is time for all organisations, including your own, who bear responsibilities in this matter, to heed the evidence and to take an active role in reducing fire fatalities. It does not seem that there is any justifiable reason for any other course of action.


Lieutenant Russell Ashe

"This is information that no one in this fire fire station had until a few days ago..."

- stated by Lieutenant Russell Ashe in June 2006 in Barre City, Vermont, after viewing the World Fire Safety Foundation's film 'The Aquarium Test.'
What inspired these 'Medal of Honour' fire-fighters to join the global campaign to help reduce fire fatalities? Find out at: www.TheWorldFireSafetyFoundation.org/ffus

TIMELINE

1935 Swiss physicist, Walter Jaeger, develops ionization device to detect poisonous gas.

mid-60s Manufacturers recruit firemen and use misleading advertising to sell new ionization 'product of combustion' detectors (falsely) claiming that ionization alarms will detect fire "before any visible sign of heat or smoke."

1976 US National Bureau of Standards (NBS) conduct first scientific 'real world' smoke alarm tests. The 'Dunes Test' report elaborated conclusions that do not disclose the long delay (over one hour on average) of ionization alarms to detect smouldering fires.

1976 Dick Patton, Fire Protection Engineer, distributes 3,000 'Smoke Detector Fraud' reports claiming NBS failed to disclose to the public that ionization alarms did not safely detect smouldering fires in the conclusions of the 1976 Dune Tests.

1978 John Gerrard, Chief Engineer and GM, LA Fire Department, discovers ionization alarms are defective in 'California Fire Chiefs Tests'.

1978 IAFC requests **4%** maximum limit by Underwriters' Laboratories (UL) in ionization smoke tests. UL tests to **10%** per foot.

1979 Walter Schuchard, Fire Protection Engineer publishes 'Smouldering Smoke' article in NFPA journal warning that ionization alarms do not respond to smouldering synthetics and warning that the UL217 testing of ionization alarms in smouldering fires is inadequate.

1980 John Gerrard heads special committee that publishes the 'Residential Smoke Alarm Report' in the 09/1980 issue of 'The International Fire Chief.' This International Association of Fire Chiefs' (IAFC) report warns that **despite US federal government tests**, ionization smoke alarms **"...will not respond quickly to a smouldering fire ... lives may be in danger"** and that **"...promotion and advertising** [of ionization alarms] **is misleading the Fire Chiefs and the public." Gerrard explains a smouldering fire test that Fire Chiefs can perform so they can see for themselves the dangers of ionization alarms.**

1980 UL produce a test that allows ionization alarms to pass because of high US home fire death rate (9,000 p/a). Only expensive, hard-wired photoelectric available - battery ionization alarms were immediate solution. However, when LED technology was developed for photo-electrics 5 years later (i.e. they also became battery operated) the **tests for ionization alarms were NOT revised.**

1980 John Gerrard appears on Utah TV, **recommending photoelectric alarms and** warning about the ionization alarms.

1985 US retailer, Sears Roebuck was fined $2.8M when the failure ionization alarms led to 3 deaths. Lawyer Edward M Swartz describes ionization alarms as 'evil' because they **"...lull consumers into a false sense of security."**

1986 Prudential High Rise Fire. Despite thick smoke on upper floors ionization alarms fail to operate. Boston, Massachusetts Fire Department (BFD) reports the most likely reason as ionization detector's inability to detect 'large particle' aged smoke.

1990 Chief Jay Fleming (BFD) is assigned to research smoke detector technology to devise a solution after 5-person fire fatality.

1996 US 20/20 documentary: After 100s of written complaints, the world's largest smoke alarm manufacturer denies the problem with ionization alarms claiming "if those fires had been serious fires the [ionization] alarms would have gone off."

1996 Due to Chief Fleming's research, the Massachusetts Building Code limits the use of ionization technology.

1998 $21.3M settlement in Mercer case after ionization alarm fails and Bradley Mercer dies. **Punitive damages** awarded because manufacturer **"failed to disclose the known limitations of the [ionization] detector to the consumer."**

1998 Chief Fleming presents paper 'Ionization vs Photoelectric Detectors - A Review of the Literature' to the National Fire Protection Research Foundation Symposium and forwards it to CPSC, NIST & USFA.

1999 Chief Fleming submits extensive research data to NFPA72 warning that detectors utilizing ionization technology as the only means of detecting a fire, should not be allowed in residential occupancies. The NFPA72 Committee responds:
"The Committee feels that the data does not make a sufficiently compelling case for the banning of an entire technology. There would need to be **clear evidence of a sufficiently compelling hazard in order to justify a change** that would deny ionization technology to consumers and to **literally put companies out of business.** A comprehensive testing project is being considered by the US Consumer Safety Product Commission (CPSC). If these tests indicate a compelling reason to ban ionization technology the committee will reconsider." (emphasis added)
Note: The NFPA72 committee **does not refute any aspect of any of the research data** supplied by Chief Fleming.

12/1999 The Washington Post article, 'How Safe are Products Bearing the UL Mark?' exposes UL's inadequate testing criteria.

01/2000 Canadian TV airs 'Silent Alarms' showing scientific tests of smouldering fire where ionization alarms had over a 75% failure rate.

06/2000 World Fire Safety Foundation (WFSF) founders Adrian Butler & Karl Westwell start campaign after viewing 'Silent Alarms'

2001 Mercer case settles out-of-court with a settlement amount protected by a confidentiality order.

06/2003 National Institute of Standards & Technology (NIST, formerly **NBS**) publishes a report **containing misleading conclusions** that is used by Fire Brigades and safety organisations globally to justify the ongoing promotion of ionization smoke alarms.

04/2004 Australian Standard 1670.1 mandates *photoelectric* alarms in sleeping areas and exits ways in **commercial buildings.**

09/2004 Dick Patton & Adrian Butler warn about ionization alarms on Australian TV. David Isaac, Fire Protection Assn. concurs.

09/2004 David Calvert, New Zealand Safety Council CEO launches the WFSF's 'Stop the Children Burning' documentary in Tasmania, Australia. Fire Survivors and fire safety campaigners from USA, Australia and New Zealand attend.

01/2005 Adrian Butler, WFSF, appears on New Zealand TV stating, **"the problem (with ionization alarms) goes back to the Standards."**

04/2005 On ABC Radio, Adrian Butler discusses litigation concerns with ionization alarms based on US legal precedents.

01/2006 The subcommittee of the Massachusetts State Building Code Board votes unanimously to limit the use of ionization technology due to their failure to adequately detect smoke from smouldering fires.

02/2006 After reviewing research data from Chief Fleming, case histories relating to ionization alarms supplied by US attorney Mr Jim Fetterly (page 13), and other research, the Australian Standards Committee FP2 discover inadequate acceptance criteria for ionization alarms and commit to resolving the problem (see quote on page 8 from David Isaac, ASFP2 Committee Member).

04/2006 In Utica, N.Y., the world's largest manufacturer was fined **punitive damages** when two die after ionization alarms fail.

05/2006 David Isaac and Adrian Butler discuss on ABC Radio possible legal implications of the New York case and ionization alarms.

05/2006 TV New Zealand demonstrates the failure of **Ionization alarms in scientific tests** by the Building Research Association of N.Z.

06/2006 **After extensive research** the Australasian Fire Authorities Council publishes **'Position on Smoke Alarms in Residential Accommodation'** document that recommends the installation of **ONLY photo-electric alarms** in Australian and N.Z. homes.

06/2006 After WFSF's Aquarium Test on Australian TV, Vermont fire-fighters produce and publish on the Internet, the first US Aquarium Test.

06/2006 The attempt of Aust. Std. to rectify **residential** Standard is blocked by the ABCB due to misleading conclusions in 2004 NIST Report.

07/2006 Based on a paper by Chief Fleming, UL and the International Fire Protection Research Foundation commit to analysing different types of smoke emitted in home fires. This study will fulfil the wishes of researchers first documented over 25 years earlier (i.e. the IAFC's 1980 'Smoke Alarm' report), which was largely forgotten until Chief Fleming's research.

10/2006 On 15 Oct 06, Chief Fleming sends the unpublished critique to NIST about their 2004 Smoke Alarm Report that is utilised by Fire Brigades and other authorities globally (Technical Note 1455 - 07/2004). **NIST'S CONCLUSIONS ARE CONTRADICTED BY THEIR DATA.** NIST does not respond. See 'NIST Report Exposed' (page 10).

12/2006 Chief Fleming has filed more than 30 complaints of fire fatalities with US Consumer Product Safety Commission (CPSC) that include: 3 fatalities at Miami University of Ohio (04/05), 1 at University of Nebraska-Lincoln (12/06), 5 at Barre, Vermont (12/05) and 2 in Newport News, Virginia (10/06). **CPSC do not respond to any of Chief Fleming's complaints.**

02/2007 ASFP2 submit further evidence to the ABCB to rectify inadequate acceptance criteria for ionization alarms.

02/2007 WFSF's 'Aquarium Test' show **ionization alarms failing** in tests by **US Fire-fighters** that adhere to the specifications of the IAFC's 1980 Report **(see 1980).**

The Purpose of this Report is:

1) To highlight potential legal implications for the Australian Building Codes Board (ABCB), regarding the delay in adopting and referencing a critical amendment to Australian Standard 3786 - *Smoke Alarms.*
2) To alert the public to the fact that the ionization smoke alarms supposedly protecting their families are inherently dangerous.
3) To inform businesses and organisations globally of their vulnerability to litigation if they recommend, sell or install ionization smoke alarms.

Two Alarm Types

There are two common types of residential smoke alarms: the ionization and photoelectric. Ionization-type alarms account for almost all smoke alarms installed in residential accommodation.

The Detector of Invisible Smoke

In the late 1930's a Swiss physicist, Walter Jaeger, endeavoured to invent an ionization device to detect poisonous gas. Jaeger used a small amount of a highly radioactive material that emitted thousands of ions every second into his devices' ionization sensor. Jaeger thought that when poisonous gas entered the sensor it would bind with the ionized atoms in the air thereby causing a drop in current which would be detected by the electronic circuitry in his detector.

In an attempt to effectively operate his detector, Jaeger blew hot smoke from a cigarette into the sensor which registered a drop in current. However, Jaeger's detector was **NOT** activated by the **visible** smoke but by the **invisible,** hot 'particles of combustion' (i.e. less than 1 micron in size) *contained within* the smoke. Ionization detectors do not detect visible smoke - they are **only** triggered by *invisible, sub-micron* particles.

Ionization detectors were first marketed in the US in the 1960s in competition with existing heat alarms and photo-electric smoke alarms. Manufacturers claimed this new device would activate *before* any heat or smoke was noticed and recruited fire-fighters to sell and promote what they called a 'product of combustion detector'.

> **"Ionisation detectors are 'product of combustion detectors', NOT smoke detectors and the public have been mislead into thinking all smoke alarms are equal."**
> Daryl Brown, G.M., Chubb Fire & Safety, New Zealand

The Number One Fire Myth

When ionization detectors 'false alarm', the public are lulled into a false sense of security and think the alarms are 'really sensitive' - especially when the false alarms frequently occur despite the lack of visible smoke.

Even though **no visible smoke** may be present, ionization alarms can activate when:

- **Cooking toast.** The red hot elements in your toaster create *invisible particles of combustion*.
- **Cooking a roast or grilling.** Opening an oven door when cooking a roast, or fumes from grilling steak releases *invisible particles of combustion.*
- **Having a BBQ.** *Invisible particles of combustion* are emitted from hot coals, electric elements or gas from your outside BBQ which can activate an ionization alarm inside your home.
- **Mowing the lawn.** *Invisible particles of combustion* from the exhaust fumes of a whipper snipper/line trimmer outside an open window can activate an ionization alarm in your bedroom.
- **Starting your car.** *Invisible particles of combustion* from the exhaust fumes of cars, boats and motor bikes can trigger an ionization alarm in your garage.

These examples demonstrate how ionization 'smoke' alarms detect *invisible particles of combustion* which cultivates the number one fire myth:

> **"My smoke alarm goes off when I burn the toast - so I'm ok."**

This fire myth prompted US lawyer, Edward Swartz from Swartz and Swartz to state that because of their frequent false alarming, ionization alarms **"lull consumers into a false sense of security."** He also said that ionization alarms can **"end up taking the very lives that they were intended to save."**[6]

Tragically, despite frequent false alarming, ionization alarms do NOT detect cool *visible* smoke from smouldering fires because this type of smoke does NOT contain sufficient sub-micron particles to activate the alarm. Unfortunately, the type of fire that is most likely to occur while you are sleeping (when you are most vulnerable) is a smouldering fire.

Scientific Evidence and Legal Implications

In June 2006, the Australian Standards Fire Protection Committee FP2 issued a critical amendment to AS3786 and submitted it to the ABCB as **a matter of urgency** for inclusion in the 2007 Building Code of Australia (BCA).

The amendment was initiated after the discovery of serious flaws in the Australian Standards smoke alarm acceptance criteria for ionization devices.

The recommendations advocated by the amendment are supported by scientific evidence and legal precedence that unequivocally establish the inherent dangers of ionization smoke alarms in residential applications.

Smoke Alarm Recall

" ...what we discovered to our horror, as the Australian Standards Committee, doing some enquiries into test data, was that ionization smoke alarms are allowed to go to 50-60% [smoke] obscuration per metre ... Dangerously High, Totally Unacceptable!"

David Isaac, Australian Standards FP2 Committee Member, from 'Smoke Alarm Recall' at: www.TheWorldFireSafetyFoundation.org


David Isaac

The Science

Recent scientific research confirms that ionization smoke alarms (both battery and hard-wired) are dangerous: in the case of smouldering fires, the type of fire that most commonly kills sleeping occupants, ionization alarms typically do NOT provide sufficient time to safely escape.

In contrast to this, **photoelectric smoke alarms provide sufficient time to safely escape both smouldering and flaming fires.**[7]

The World Fire Safety Foundation has noted that the general public has very little awareness of photoelectric smoke alarms,[8] and that availability of these devices is limited.

BRANZ Publishes Tests

The public has been misled into thinking ionization alarms will activate early in *any* type of fire. The following is typical of results from scientific tests performed over the past 30 years.

In May 2006, the Building Research Association of New Zealand (BRANZ) subjected ionization and photo-electric alarms to flaming and smouldering fires under controlled scientific conditions.[9]

In the smouldering fire tests the photoelectric alarms provided sufficient early warning. However the ionization alarms failed the same smouldering fire tests, resulting in the following dialogue between Corinne Ambler of TVNZ and William Whitley of the New Zealand Consumer's Institute, that was aired on prime-time New Zealand TV:

CA: **"That's pretty shocking though isn't it?"**
WW: **"It is - it's a big worry"**
CA: **"I mean, you buy a smoke alarm, you expect it to go off."**
WW: **"Precisely - and it may not."**

> **"The public believes that by buying a common smoke detector off the shelf, that before their house was filled with smoke that detector would sound and give them a warning. I think they believe that ... That is ABSOLUTELY NOT what will happen."** (emphasis added)
> Dr B Don Russell, PhD, Texas A&M University

Legal Precedence

As already stated, scientific evidence and legal precedence has established that "perfectly legal, properly functioning, Underwriters Laboratories-approved"[10] ionization smoke alarms are dangerous in residential applications because of their known, dangerous performance limitations in smouldering fires.

Legal precedence in this matter derives from the landmark Mercer case where Judge Schoenthaler surmised...

> **"A smoke detector that sounds approximately 19 minutes after smoke reached its sensing chamber is like an air-bag that does not deploy until 19 minutes after a car accident."**[10]
> Hon. David E Schoenthaler, US Mercer case (04/1998)

Regardless of the known and dangerous defects of ionization alarms, manufacturers continue to mass-produce them, retailers continue to recommend and sell them, and electricians continue to install them.

The Excuse for Continued Sales

In the process of marketing ionization smoke alarms, it is frequently claimed that "ionization smoke alarms respond faster to flaming fires, while photoelectric smoke alarms respond quicker to smouldering fires."

Whilst this statement is *technically true* it totally lacks integrity. The Foundation believes that such statements, without further qualification, could be deemed criminal acts of negligence.[11]

What is *not* explained to the public in such statements, is that **while BOTH types of alarms provide sufficient time to safely escape from flaming fires, ionization smoke alarms typically do NOT provide sufficient time to safely escape from smouldering fires. Photoelectric alarms DO typically provide adequate time for safe escape from smouldering fires.**

The marketing of ionization alarms persists because they currently pass global Standards, even though published scientific research and legal precedence substantiate that **recommending, selling or installing ionization alarms could be deemed criminal acts of negligence.**

The Foundation's *Aquarium Test* film contains revelations by a member of the Australian Standards Fire Protection Committee FP2 that the global requirements for Standards testing of ionization alarms have been proven as inadequate and that ionization smoke alarms are not 'fit for purpose' in residential applications.

The credibility of the procedures for smoke alarm testing has been challenged for over thirty years.[12] In 2006, the Australian Standards FP2 committee investigated the testing requirements for smoke alarms in Australia. They discovered that **if ionization alarms were required to pass the same Australian Standards smoke sensitivity criteria as photoelectric smoke alarms they would fail.**[12]

Q. Why did the ABCB Block Revising the Standard?

The ABCB has blocked the adoption of the revised Australian Standard 3786 for inclusion in the 2007 Building Code of Australia (BCA).

The blocking of this amendment disregards the abundance of research and proposals by numerous authorities confirming the serious performance limitations of ionization smoke alarms. It ignores research and recommendations proposed by:

- Australian Fire Brigades,
- the Victoria University of Technology (commissioned by the AFAC),
- Australian Standards FP2 Committee and,
- commentary on international research by Deputy Chief Joseph E Fleming of the Boston Fire Brigade (USA).

scientific papers and commissioning the Victoria University of Technology (VUT) to undertake research.

Based on independent research, the VUT Report and concurrent research initiated by Australian Standards Committee FP2, the Australasian Fire Brigades have dismissed the traditional policy and politics of advocating ionization alarms by promoting photoelectric. These Fire Brigades have displayed great courage and integrity.[14]

On 01 June 2006, AFAC released their document: *Position on Smoke Alarms in Residential Accommodation.* This states (Page 3, Para 1): [13]

> **"That all residential accommodation be fitted with *photo-electric* smoke alarms."**

The World Fire Safety Foundation endorses the Australasian Fire Authority Council's Position Statement. The AFAC's Position Statement is available at: www.TheWorldFireSafetyFoundation.org/afac

ABCB - Reflecting Public Expectation

Given that the ABCB's mandate is to introduce and maintain legislation that reflects the 'public expectation of safety', please advise the World Fire Safety Foundation in writing by Tuesday, 20 March 2007 as to:

1) The reasons for the ABCB blocking the introduction of the proposed June 2006 amendment to rectify AS3786, despite the scientifically proven, life-threatening limitations of ionization smoke alarms?
2) The reasons for the ABCB's failure to discharge its Duty of Care by not informing the public of the known and scientifically proven, life-threatening limitations of ionization smoke alarms?

While the wheels of bureaucracy continue to turn so slowly the needless loss of life continues.

To: All Recipients

Please watch the Foundation's films [15] and examine this Report so you may evaluate the safety, legal and moral implications of this issue for your family and your business/organisation.

To: ABCB Staff and Board Members

We ask that you personally, and the ABCB collectively, help save lives by creating a means to ensure the incorporation of the proposed June 2006 amendment to AS3786 into the Building Code of Australia as soon as possible.

The Foundation's Objectives are:

1) To facilitate the mandate for photoelectric smoke alarms in all residential applications globally.
2) To ban the sale of ionization-only [16] smoke alarms for residential applications.

Our Mutual Objectives - A Safer Future

Because this information has been hidden for over 30 years, the public are deprived of an informed choice in properly protecting their families from fire.

When ionization smoke alarms are finally eliminated from homes, effective and affordable photoelectric smoke alarms will fill the void saving countless lives around the world.

EVIL PERSISTS WHEN GOOD MEN DO NOTHING!

"A Positive Evil"

"The point about [ionization] smoke detectors is that they are not 'neutral'; they are a positive evil because they prevent people from doing what's necessary to make their homes safe."
Edward M Swartz
Trial lawyer, Swartz & Swartz, Massachusetts, USA

"... Fetterly argued that the company marketed the inferior [ionization] smoke alarm - selling 100 million of them - without warning the public about the differences in the two, forcing consumers to make an uninformed choice between savings and safety."
James Fetterly
World's #1 Fire Industry Litigator, Minnesota, U.S.A.

"Continuing to endorse the ionization devices on any ground is to reward ethically bankrupt manufacturers and to collude with their deceitful reassurances."
Kerrin R Edwards, M.A.
Senior Consultant in Business Ethics, NSW, Australia

www.TheWorldFireSafetyFoundation.org

1 The Australasian Fire Authorities Council (AFAC) is the peak representative body for all Australian and New Zealand Fire Brigades. Their document *Position on Smoke Alarms in Residential Accommodation* (01 June 2006) is available at: www.TheWorldFireSafetyFoundation.org/afac

2 Statement by Edward M Swartz, Trial lawyer of Swartz & Swartz, (MA USA) in the 1985 law suit when US$2.8M was awarded against US retailer Sears & Roebuck in regard to a house fire that killed three boys and seriously injured their sister. The July 1985 edition of *Lawyers Alert Magazine* contained several quotes that included: "A malfunctioning smoke detector can create an unreasonable risk of harm in that the inhabitants of a [house] who rely on such an alarm may be lulled into an unjustified sense of safety and fail to be forewarned of the existence of a fire."

3 http://SmokeAlarm.nist.gov

4 www.TheWorldFireSafetyFoundation.org

5 The September 1980 issue of the *International Fire Chief* contained the landmark IAFC *Residential Smoke Alarm Report* and is available at: www.WorldFireSafetyFoundation.org/docs

6 Stated by Trial lawyer, Edward M Swartz, *'Lawyers Alert Magazine*, July 1985.

7 A 'smouldering' fire occurs when a fire emits smoke but has not yet broken into flame. A 'flaming' fire occurs when a fire, which will is often initially a smouldering fire, has broken into flames.

8 The Foundation believes that the optimum fire detection device is a combination heat/photoeletric alarm, despite that it is not yet commonly available for homes. In their *Residential Smoke Alarm Report* (09/1980) the International Association of Fire Chiefs stated: "The Subcommittee ... does not think the combination [ionization/photoelectric] detector is best." Residential Home Smoke Alarm Report, 09/1980, Appendix B, Page 6, Para. 2 at: www.TheWorldFiresSafetyFoundation.org/iafc

9 The media release by the New Zealand Consumer's Institute - *Common Smoke Alarms Give Inadequate Warning* 02 June 2006 www.consumer.org.nz/newsitem.asp?docid=2611&category=News&topic=Media%20release%20-%20Some%20smoke%20alarms%20inadequate

10 **The Mercer Case (04/1998)**

A statement by the Hon. David E Schoenthaler as he awarded US$12.5M in punitive damages against an ionization smoke alarm manufacturer in the precedent-setting Mercer case (04/1998) when an ionization alarm failed to sound a timely warning: it entailed the death of Bradley Mercer and severe burns to his brother.

In January 2000, Canadian Television aired an award-winning documentary exposing ionisation alarms and elaborating the Mercer case. *Silent Alarms* stated that Judge Schoenthaler had found that the smoke alarm manufacturer had **"...done more than ignore the problems with its detectors, it actually covered them up. In the Judges decision he concluded that even though** [the manufacturer] **knew that their** [ionization detectors] **were flawed, despite that knowledge** [the manufacturer] **failed to disclose the known limitations of the [detector] to consumers." Note:** In 2001, after an appeal, the Mercer case settled out of court with a confidentiality order. www.TheWorldFireSafetyFoundation.org/mercercase

The Hackert Case (04/2006)

The same manufacturer failed to shield their culpability from public view in April 2006 after two people died in Rotterdam, New York. That case was described as "...one of a handful of an apparently growing number of cases where a manufacturer of smoke alarms is **found liable for selling a perfectly legal, properly functioning*, Underwriters Laboratory-approved product.**"

Litigator James E Hacker (Hacker & Murphy LLP) uncovered "...750 complaints from consumers whose ionization type detectors failed to sound during smoke or fire events.**" Hacker commented "We like to think this is a significant case ... it is a story that needs telling ... **it is unconscionable for a company to continue to market an inferior product.***"

In his *Memorandum Decision & Order* (08 Nov 06) Judge Hurd wrote: "... the jury determined the design of defendant's ionization smoke detector was defective and **the defendant was negligent in failing to use ordinary care in the design, testing, marketing and sale of the alarm."**

* In this context "properly functioning" refers to a smoke alarm with a functioning (i.e. charged) battery, - this does NOT refer to, or imply, that ionisation smoke alarms function properly as they do NOT detect common, life-threatening smouldering fires in a timely manner.

** *New York Law Journal 5/8/06 Volume 235 - Westlaw NYLJ, 1, (col. 6), Page 1, Para. 2.*

*** *Colorado Fire Journal 5/1/06 Issue 2006-19, Page 18* www.ColoradoFireChiefs.org/data/DFS_Info/2006_DFS/Fire%20Safety%20News%20050106.pdf

Note: More information on these cases and other litigation is on Page 13. www.TheWorldFireSafetyFoundation.org/hackertcase

11 "...such statements, **without further qualification**, could be deemed criminal acts of negligence". In the landmark 1998 Mercer case Judge David E Schoenthaler awarded US$12.5 in punitive damages because the manufacturer .."failed to disclose the known limitations of the [ionization detector] to consumers." (see 10 above)

12 The Washington Post article *How Safe are Products Bearing the UL Mark* exposes the problem with global standards testing and is available at: www.TheWorldFireSafetyFoundation.org/ul The Foundation's letters to Underwriters Laboratories (the world's largest standards testing laboratory) regarding inadequate smoke alarm testing requirements are available at: www.TheWorldFireSafetyFoundation.org/ulletters.
In September 2006, acceptance criteria inadequacies with the Australian smoke alarm Standard were made public in the Foundation's film, ' SmokeAlarmRecall' at: www.TheWorldFireSafetyFoundation.org

13 NIST's report, *Performance of Home Smoke Alarms* (Technical Note 1455, 07/2004) is at: http://smokealarm.nist.gov/HSAT.pdf

14 Commissioner Greg Mullins AFSM, Chief Fire Officer and CEO of the NSW Fire Brigade wrote in his August 2006 letter to the WFSF: "As you are aware, the New South Wales Fire Brigades (NSWFB) has spent a great deal of time analyzing the research and findings of a wide range of investigations including the NIST Report (Technical Note 1455), the White Paper (The Public/Private Fire Safety Council), papers by Joseph Fleming and others. Your assistance in this respect was greatly appreciated. The result of this investigation was amendment of the "NSWFB Position on Smoke Alarms" **to strongly recommend the installation of photoelectric alarms in all homes. I have publicly advocated this in numerous radio, TV and newspaper interviews, and ensured that all NSWFB firefighters are aware of, and communicate, this position.** As you are also aware, the NSWFB worked very closely with the Australasian Fire Authorities Council (AFAC) in amending the AFAC Position on Smoke Alarms to reflect the same position." [emphasis added]

15 'Smoke Alarm Recall' (formerly 'The Aquarium Test) is at: www.TheWorldFireSafetyFoundation.org
'Stop the Children Burning' is at: www.TheWorldFireSafetyFoundation.org/stcb

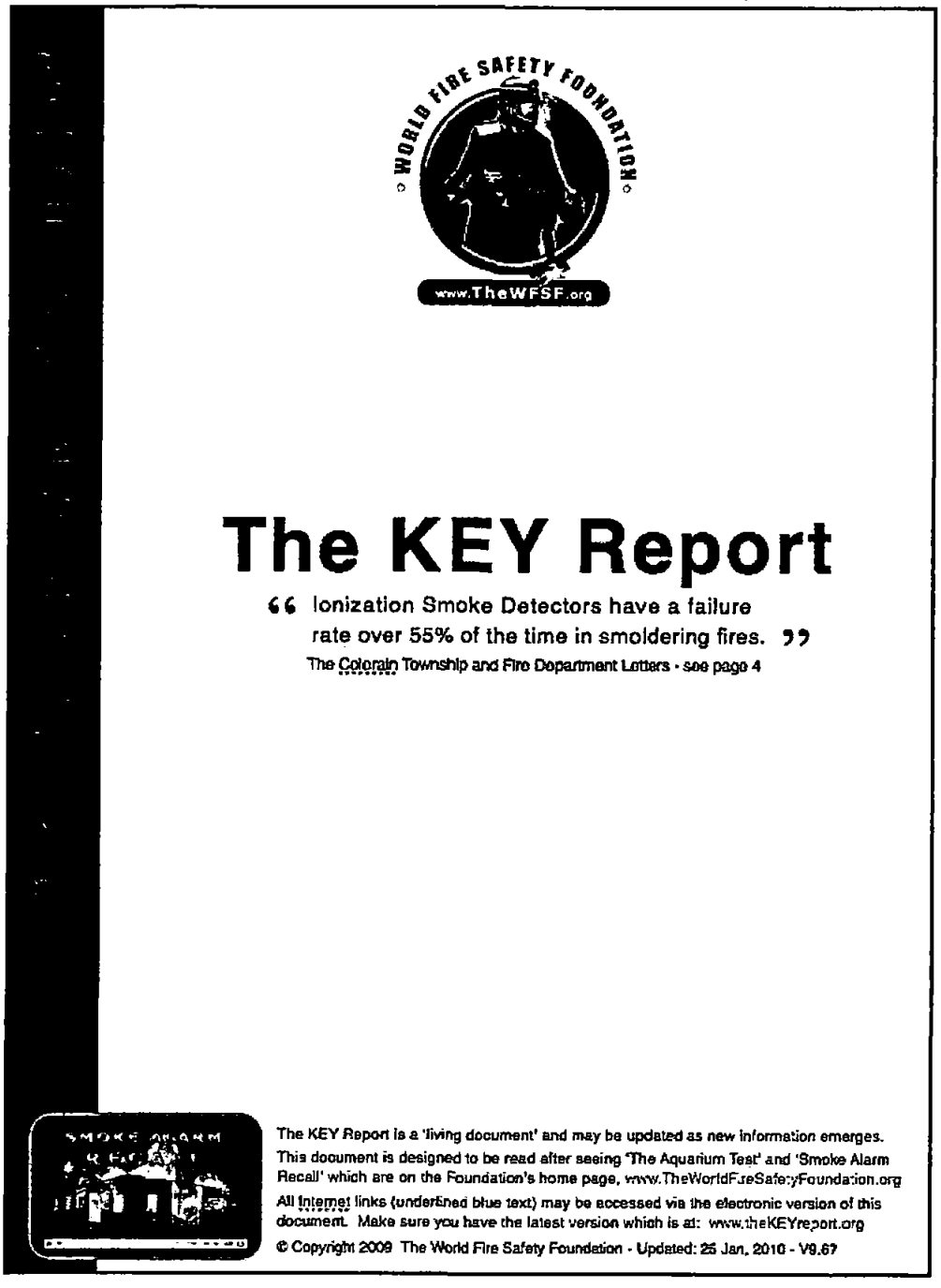
16 The Phrase 'Ionization-only' refers to single station smoke alarms as opposed to dual/combination alarms that utilize both ionization and photoelectric technology. In reference to these dual alarms, the AFAC concurred with the IAFC's *1980 Smoke Alarm Report* and declared: "Smoke alarms fitted with dual photoelectric/ionization detectors are available ... however they are more costly and prone to more false alarms ... and the benefits are marginal." (Position on Smoke Alarms in Residential Accommodation, 06/2006, Page 3, Note 6.) www.TheWorldFireSafetyFoundation.org/afac

The KEY Report

Since senior management and all Board members of the ABCB received The CAN Report, in February 2007, by registered mail, they have failed to adopt the critical amendment to Australia's smoke alarms standard.

Despite numerous requests the ABCB has failed to provide just cause for their inaction.

The KEY Report was written to provide stake holders with the evidence as to why the ABCB's ongoing failure to adopt the amended Standard may be deemed to be criminally negligent.



www.theKEYreport.org

PHOTOELECTRIC SMOKE ALARM

HIGH QUALITY PHOTOELECTRIC SMOKE ALARM FOR YOUR HOME

Photoelectric Smoke Alarm – The Best Smoke Alarms For Your Home To Protect Your Family

You've made the decision to install or update your smoke alarms. Your family and the home you live in require the best protection against fires in the home but which one can give you the safety you're searching for? A **photoelectric smoke alarm** is the best choice. Let's take a look at why that is and why a photoelectric smoke alarm is the superior choice for your home or small office.

Firstly, we need to understand how fires typically begin in the home environment. It's important to realize that while smoke alarms alert you to the presence of a fire they cannot outright prevent them. But how do these fires begin? Fires in the home often begin due to faulty electrical wiring in items such as electric blankets, old TV's or an electrical heater that has been knocked over by accident.

These types of fires often smolder for quite some time before developing into a larger fire that can destroy your home and possibly injure or kill you and your family.

Looking at the examples of how fires in the home often begin, it make sense to look for a smoke alarm that is sensitive to smoke and not just fire. Many of these types of fires can slowly burn away and then erupt into a full blown house fire that can catch you unaware. That's why photoelectric smoke alarms are ideal for bedrooms, kitchens and dining rooms inside your house. They're suitable for every room of the home that contains any type of electrical equipment, furniture or material that is prone catching fire.

People may start to ask themselves why does it matter what type of smoke detector I purchase? I just need a smoke alarm! Did you know that not all smoke alarms are the same! A *photoelectric smoke alarm* contains a light emitting diode as well as a light sensor. Any smoke (or smoldering fire) that is in your home will be detected by the sensitive diode contained within the smoke detector thus alerting you that there is a fire hazard within your home and that you need to react promptly. Sometimes the difference between life and death are the few minutes you have to exit the home.

For the best protection, early detection and finally alerts, the photoelectric smoke alarm is the best choice to make when purchasing smoke alarms for your home.

BOOKMARK

Technorati Tags: photoelectric smoke alarm, photoelectric smoke alarms, smoke alarm, smoke alarms

Tagged as: photoelectric smoke alarm, photoelectric smoke alarms, smoke alarm, smoke alarms 1 Comment

Photoelectric Smoke Alarm – One Of Two Types Of Smoke Alarms

If you're considering installing a smoke alarm within your home and are a little confused about the various types of devices available to you, one could forgive you for feeling a little lost. With such a wide range of devices available for purchase, smoke alarms can be defined into two categories. The first is known as ionization smoke alarm, the second is a photoelectric smoke alarm.

Still confused? Let's take a look at the differences between these two types of smoke alarms and how they work, this will allow you to make an informed decision as to which is suitable for your home and family.

A great analogy for the way in which an ionization smoke alarm works is the same way in which your sense of smell functions. The device tests and detects the presence of smoke particles in the air. Ideally, these kinds of smoke detectors are suitable for industrial areas where fires ignite due to chemicals or explosive materials fueling the fire. Many people have made the mistake of installing these within their home, either not knowing or flat out ignoring the advice to do otherwise. Because fires within the home ignite in a different manner, this has left many people at risk of injury or death.

So if ionization smoke alarms are ideal for industrial areas or office buildings, lets look at why the photoelectric smoke alarm is the ideal smoke detector for your home or small office. Photoelectric smoke alarms differ in the way ionization smoke alarms work. Using an analogy again, a photoelectric smoke alarm functions in the same manner as your eyes do. It looks for the presence of smoke.

Photoelectric smoke alarms contain a Light Emitting Diode that scans the room for smoke. Being an optical device, should any smoke block the projected light, it will trigger the alarm. These are most effective for the home or small office because fires within these types of buildings generate a lot of smoke before a fire really takes hold. Whether it's electrical blankets, faulty electrical wiring in the laundry etc, home fires produce much more smoke than chemical or industrial fires do in their early phases.

Now that you understand the fundamental differences between the two smoke alarms, it's a no brainer that you should opt to install a photoelectric smoke alarm within your home. There is one last thing I'd like to share with you though.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What if you want smoke alarms that detect the presence of fire in both ways? The great news is you can purchase dual ionization-photoelectric smoke alarms.

These devices utilize both methods of detection and because of that, they are a little more costly than a singular device. Having said that, if the cost is a non-issue for you, they're a great item to purchase. If value for money is a larger consideration, opt for the photoelectric smoke alarm over the ionization type. Photoelectric smoke alarms are far better in the detection of fire in your home, ionization smoke alarms are known to have a much higher failure rate which could put you at risk.

You can purchase photoelectric smoke alarms through Amazon.com for prompt delivery at an affordable price.

Technorati Tags: ionization smoke alarm, photoelectric smoke alarm, smoke alarm

Tagged as: ionization smoke alarm, photoelectric smoke alarm, smoke alarm No Comments

The photoelectric smoke alarm is your answer to annoying false positive fire alarms

Do you have a smoke alarm that constantly makes noise any time you begin cooking a meal for the family? It can be *quite* frustrating to hear the on-going noise and you might just be wondering if your smoke alarms are effective at all. False positives can be very *frustrating*. You don't even need to burn something to trip the alarm. You might be inclined to remove the batteries but it's not the wisest decision to make *either*. So what can you do about this problem while still maintaining an effective smoke detector in case of a house fire?

First of all, you may not be aware that there are two different types of smoke detectors and they both function differently. Which design you have can be all the difference between effective and ineffective detection of fire. The two types of technology used in these devices are known as ionization and photoelectric.

So what's the difference and which is suitable for your home?

Ionization smoke alarms work by detecting the presence of heat. If the smoke alarm in your kitchen is constantly going off, this may be the type of alarm you have installed. At first when you think about it, these types of alarms make sense given that fire produces heat, but are they the most effective type of smoke detector?

Unfortunately, they are not. So which is the best fire detector for you home? The photoelectric smoke alarm.

A photoelectric smoke alarm differs to the ionization model by detecting the presence of smoke. This is a fundamental difference in the design of the unit. While fire does produce heat, it also produces smoke. As is often the case in house fires, fires begin slowly by smoldering away, producing little heat but much smoke. A photoelectric smoke alarm is obviously better suited for environments such as the home.

If you want to have the best protection against fires for you home, I suggest removing your ionization models and installing photoelectric smoke alarms instead. They can be purchased affordably from Amazon.com and delivered to your front door in a timely manner. This way you can "hit two birds with one stone", ensuring your home has adequate smoke detectors and you'll avoid the false positive alarms that ionization models are associated with while cooking.

Technorati Tags: ionization smoke alarm, photoelectric smoke alarm, smoke alarm, smoke detector

Tagged as: ionization smoke alarm, photoelectric smoke alarm, smoke alarm, smoke detector No Comments

Photoelectric Smoke Detectors – The First Step In Your Fire Escape Plan

If a fire ignited within your home tonight, how would you and your family escape safely without injury. Are you prepared for such an event? The best prevention and protection against such things is to develop a home fire escape plan. If you're unsure what this involves, read on for our 7 step guide. It's simple, straight forward an effective.

1) Install and ensure all **photoelectric smoke detectors** within the home are functional. Besides changing the battery once every 12 months, it's also important to test the smoke detector on a monthly basis to ensure proper working order. All photoelectric smoke detectors should contain a button that allows you to test the alarm. If you cannot find the button, consult the manufacturers guide for further information.

2) Draw up a floor plan of your home and plot it out upon grid paper. If you live in a multistory building or block of units, you'll need to draw up a plan for each level of the building and distribute this to each member of the family.

3) On the floor plan you will want to note 2 emergency exits for every room of the home. It is often the case that when a home fire occurs, the doors can be blocked from possible escape due to the fire. Windows are naturally your second method of escape. If you have installed security shutters or security bars, ensure these have a quick release function that can be used from within the house.

4) Who might need assistance escaping? If you have elderly or sick parents living with you and/or younger children who are unable to walk, it's important to plan out who will assist them in the time of an emergency. You can save time in an emergency by placing people at higher risk, in rooms that are closer to escape exits.

5) Decide on a place to meet outside. Select an area where roll-call can be taken that is within walking distance from

your home. Ideally this should be a friends or neighbors home. Everyone needs to be aware that this is the place to congregate at, in the event of a fire.

6) Contact the fire brigade once you have evacuated the home. Don't stop to make the call within the home or while on the way out as you'll lose focus and may panic. You could put yourself at risk of injury or death. Furthermore, do not stop to collect personal belongings or other items while exiting the building. The fire department can assist you in removing these items once the fire has been extinguished.

7) Practice your escape plan. With everyone present, go through the escape plan step by step, ensuring each member of your family understands what to do in the event of a fire. Schedule a fire drill once per year to refresh this in every ones mind.

Remember! Identify 2 ways of escaping each room, hold a fire drill once per year and ensure your photoelectric smoke detectors are installed and working correctly.

Technorati Tags: fire escape plan, photoelectric smoke detector, photoelectric smoke detectors

Tagged as: fire escape plan, photoelectric smoke detector, photoelectric smoke detectors No Comments

Photoelectric Versus Ionization – What Is Most Effective For You And Your Family?

Most people are unaware that there are different types of smoke detectors available. Perhaps they mistakenly purchased smoke alarms online or at the local hardware store, often based on advice that is well intended but misinformed and dated.

After arriving home and installing the smoke alarms, home owners then feel they've done the right thing and now have proper fire detection devices in their home. Unfortunately, many people opt to install smoke alarms which use ionization as the method of detection when they should install a **photoelectric smoke alarm** instead. The difference between the two are alarming and have the potential to save the life of you and your family.

The KEY report is a document that outlines why ionization smoke alarms are failing people and costing lives in the process. Most people are under the belief that their smoke alarms are annoying yet effective due to the constant sound of the alarm when opening an oven or burning their toast. All fires differ and generally speaking, fires within the home have a tendency to smolder which ionization smoke alarms are not designed to detect. This puts you and your family at unnecessary risk of injury or death. So what can be done about it?

Fortunately, change is at hand and many people are now becoming informed about the role a photoelectric smoke alarm plays in providing effective detection of fires within and around the home. The KEY Report, published by The World Fire Safety Foundation aims to inform consumers about the dangers of ionization smoke alarms and provides reading and video material to assist consumers in making an informed decision so they can best protect themselves in case of an emergency.

For further information, you can visit the website of The World Fire Safety Foundation and there you can find their offer of a free 25 page KEY report into why photoelectric smoke alarms are the best choice for your home and the dangers and risk that ionization smoke alarms are putting homes and families in.

Technorati Tags: ionization smoke alarms, photoelectric smoke alarm, photoelectric smoke alarms, smoke alarm, smoke alarms

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But Alexander said customers' response hasn't been positive.

"Our customers say they are harder to smoke and the taste isn't the same," Alexander said.

According to the coalition, states that already had implemented fire-safe cigarette laws are New York, Vermont, California, Oregon, New Hampshire, Illinois, Maine, Massachusetts, Kentucky, Montana, New Jersey, Connecticut, Maryland, Utah, Alaska, Rhode Island and Minnesota, as well as the District of Columbia.

Idaho, Indiana, Kansas, Colorado, Arizona, Washington, Louisiana, Hawaii and Wisconsin have laws that take effect this year, according to the coalition's Web site. Florida, Georgia, North Carolina, Tennessee, Virginia and South Carolina have laws that will take effect in 2010.

Some states such as Texas are giving retailers a grace period to sell off their old inventory.

University of Washington finds smoke alarm differences in two major types

By Associated Press (as reported in the *Seattle Times*) - April 11, 2008

Seattle, WA - Researchers in Seattle say that photoelectric smoke alarms are more likely to continue working than the more-common ionization alarms.

Their study found the ionizing detectors were more prone to nuisance alarms caused by cooking, which leads people to disconnect the battery. No battery is the most common reason alarms don't work.

Ionization alarms respond to combustion flames. Photoelectric alarms use optical sensors.

The study found that nine months after a smoke alarm was installed, 20 percent of the ionized alarms did not function, compared to 5 percent of photoelectric alarms.

The study of 750 households in Washington was conducted by the University of Washington and the Harborview Injury Prevention Research Center. It appears in the April issue of the journal Injury Prevention

Study: Kids who slept through fire alarm's tone awoke to mom's voice alert

By Associated Press - October 2, 2006

Columbus, Ohio - Children in deep sleep awoke to recordings of their mothers' voices - calling them by name and ordering them out of their bedrooms - even if they slept through the beeping sound a smoke alarm makes, according to a small study.

The study reaffirms previous research that shows what works for adults doesn't always work for children, said Dr. Gary Smith, one of the co-authors.

"Clearly, the strategy that has been tried and true and used for years...fails miserably for children," said Smith, director of the Center

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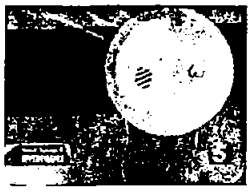

State Rep. Mike Turner

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Fire Department Reps Discuss Smoke

After a NewsChannel 5 investigation exposed problems with ionization smoke detectors, one state lawmaker decided it was time to ban those detectors here in Tennessee.

But now, state Rep. Mike Turner is finding that it's a lot easier said than done.

Consumer investigator Jennifer Kraus has been following his bill at the legislature and found that at least one smoke detector manufacturer does not want Turner's bill to become law.

That company is now spending a whole lot of money to keep it from happening which is something some say is putting lives on the line.

When Turner, a Democrat from Nashville, went before the House industrial impact subcommittee today to talk about his proposed legislation, he told lawmakers, "I truly believe in this."

Turner, who is also a longtime Metro firefighter, says his bill will save countless lives. It would require smoke detectors that studies show do the best job actually detecting smoke.

But at least one smoke detector manufacturer, Kidde, is doing all it can to kill Turner's bill.

John Andres, the company's Engineering Director, told the subcommittee, "We want the public protected."

Yet, Mike Turner knows they're here for a fight.

"We've got all these high-powered lobbyists and all these manufacturers coming in here, " Turner adds.

Kidde has hired two well-known lobbyists who sources say have been working behind the scenes urging lawmakers to reject Turner's bill, legislation that would ban the most common type of smoke detectors, known as ionization detectors.

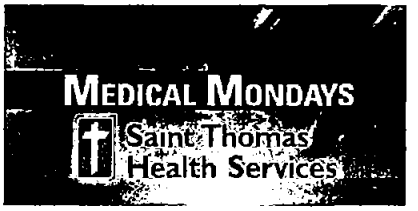
Turner isn't deterred. He says, "This bill is important to me and I am convinced that it's the right way."

But the smoke detector maker sent a team from North Carolina to today's subcommittee meeting and told lawmakers that ionization detectors can make a difference in fires with big flames.

John Andres explained, "In a flaming fire, seconds count. Flames can block your escape, create dangerous levels of heat and carbon monoxide."

But what the company representative failed to tell lawmakers was that studies show ionization detectors often fail to go off in smoky fires -- the kind that kills people as they sleep.

Turner made a point of pointing that out to the subcommittee, telling them, "He wouldn't say that



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An Alarming Failure: What the Experts Say

Lawmakers Want Law Changed to Save Lives

Lawmaker Advocates For Smoke Detector Changes

***Feds, Manufacturers* Do Little To Protect Consumers**

cause that would hurt his sales. This is about sales."

Turner believes the manufacturers are more concerned about making money than saving lives.

And the company even admitted during the hearing that it had spent millions of dollars in the research and development of several new ionization detectors that it's trying to get on the market -- and if Turner's bill passes, the money they've spent would be lost.

Turner then told lawmakers, that says it all.

And he went on to make this comparison, "This is like the cigarette companies used to say tobacco didn't cause cancer, smoking didn't cause cancer and they defended their product. We have a similar situation here. We've got outdated technology that does not work.

Turner's bill calls for ionization detectors to eventually be phased out in Tennessee and replaced by photoelectric and dual technology detectors.

He knows he's in for a fight and says he's ready. But he also says he doesn't have lobbyists working for him like the manufacturer does. So he's asking the public to contact the lawmakers on the committee and urge them to support his bill. He believes that's what it will take.

If you'd like to see the list of lawmakers and find out how you can contact them to voice your support for Turner's smoke detector legislation also known as House Bill 2528, just click **here.**

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INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

ALFRED K. WHITEHEAD
President

VINCENT J. BOLLON
Secretary-Treasurer

February 10, 1993

George Miller, President
National Fire Protection Association
One Batterymarch Park
Quincy, MA 02269

Dear President Miller:

Effective immediately, the International Association of Fire Fighters is ending its 71-year relationship with the National Fire Protection Association.

At the direction of the IAFF Executive Board, I am formally severing all relationships between the IAFF and the NFPA, including the IAFF's organizational membership in the NFPA and IAFF representation on all committees and sections of the NFPA. In addition, I have asked all IAFF affiliates in the United States and Canada and individual IAFF members to take similar action.

The IAFF will no longer be a party to an organization that has shown utter contempt and disregard for fire fighter safety on the fireground, an issue that has a direct impact on public safety and fire fighting effectiveness. The NFPA's standards-making process has been corrupted by senior staff interference in the consensus process, last minute committee restructuring to influence key votes, and decisions made for political reasons rather than on the merits.

As the representative of North America's professional fire fighters, the IAFF can no longer, in good faith, lend its name and credibility to the NFPA. Fire fighters are the backbone of any fire protection, fire prevention, or fire safety efforts, but the NFPA has ignored their most fundamental of needs, thereby jeopardizing the lives of fire fighters and the public.

Alfred K. Whitehead
General President

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02-13-2009 21:36 #1

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Age: 27
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Rep Power: 13224

Ion or Photoelectric smoke detectors? You decide!

Found on Firehouse.com

Smoke Detectors Blamed in Pennsylvania Deaths

.....

By DANA DIFILIPPO
The Philadelphia Daily News

THE SEPTEMBER NIGHT that turned Desiree Wylie's days into a marathon of misery started with a full bladder.

It was a half-hour before midnight. She awoke to use the bathroom. She knew something was wrong when she flipped the light switch and nothing happened. In the hallway, she felt a draft. Then, she smelled smoke.

Horror hit hard.

"Jessica! Fire!" she screamed up the stairs, where her 22-year-old daughter, Jessica Torres, slumbered with her sons, 4 and 3.

The ensuing chaos was full of noise: the women's cries of terror and calls for help, the thundering of their feet as they scrambled to escape, the sounds of destruction below as fire devoured the first floor.

But not the shriek of a smoke detector.

Wylie said she had at least seven scattered throughout her three-story home in Coatesville, all with fresh batteries she had put in to prepare for a recent house inspection.

"I didn't hear a single one going off," Wylie said. "All I heard was the kids screaming, us panicking."

Although firefighters universally trumpet the life-saving benefits of smoke detectors, Wylie witnessed - with heartbreaking results - the shortcomings of ionization alarms, the cheapest and most commonly used smoke detectors.

Because ionization detectors are less sensitive to the smoke produced by smoldering fires, they can take a half-hour or more longer than their competitor - photoelectric detectors - to alert residents of brewing danger.

For Wylie, that delay was the difference between life and death.

Within seconds, the smoke grew so thick that she couldn't get to her 11-year-old son, Brian Kelly Westmoreland Jr. It turned so toxic that Torres, who had smashed a third-floor window to escape, couldn't get to her sons, Tyrone and Tyzhier Hill, who had collapsed unconscious out of reach.

All three boys died of smoke-inhalation in the Sept. 21 blaze, which smoldered in a trash can behind the house before spreading. Investigators ruled the fire at Wylie's house accidental.

A crusade against ion detectors

Tragedies like Wylie's infuriate Jay Fleming, a Boston deputy fire chief. He has made it his life's crusade to educate fire and government officials and the public about the potentially deadly deficiencies of ionization, or ion, detectors.

"It's needless, just totally didn't have to happen," Fleming said of the Coatesville boys' deaths.

When it comes to fire protection, consumers have three choices in smoke-detector technology: ion or photoelectric alarms, or a hybrid of the two.

The ion device, which uses a small amount of radioactive material to create an electric current within the unit, sounds when smoke particles interrupt the current.

Photoelectric detectors use optical technology; they go off when smoke particles reflect part of a light beam onto a photo detector.

Priced as low as $7, ion alarms typically cost half as much as their photoelectric counterpart. And although both technologies have been around for decades, photoelectric units until the early 1980s had to be hard-wired, making them less popular than the battery-operated ion alarms.

That affordability and convenience made the ion alarms a best-seller. The National Fire Protection Association figures that 96 percent of American homes have smoke detectors, and Kidde, one of the top manufacturers of both detectors, estimates that 90 percent of those alarms are ions.

But the two technologies react differently to different smoke.

In flaming fires, ion alarms activate faster, by about 30 seconds, because they are more sensitive to the tiny particles such fires emit.

But smoldering fires, the type that happen overnight when people sleep, produce larger particles that set photoelectric alarms off faster - by as much as 30 minutes, according to the National Institute of Standards and Technology (NIST) and controlled burns done by Fleming for Hook, a magazine for firefighters.

Ion alarms also sometimes fail to sound in smoldering fires even when smoke has thickened enough to significantly degrade visibility, NIST acknowledged in August 2007 testimony to the Boston City Council.

Further, ion alarms are easily triggered by shower steam and cooking smoke, Fleming found, a drawback that prompts plenty of frustrated folks to yank out - and sometimes forget to reinsert - the batteries.

Because smoke can incapacitate and kill in minutes, Fleming says, such shortcomings are unforgivable.

"Since 1990, the industry's and government's refusal to recognize this problem has resulted in thousands of needless deaths," Fleming said.

Fleming believes the best fire protection is a photoelectric detector, and says fire-safety advocates should educate the public about its superiority.

He wants manufacturers to put warning labels on the packaging of ion alarms, alerting buyers to their delay in smoldering fires.

And fire investigators should start keeping track of what kinds of detectors, if any, were present in burned homes or businesses to develop data that would demonstrate which technology is better, he said.

Hook took up Fleming's cause in an exhaustive report last July, and the International Association of Fire Fighters joined their efforts shortly afterward.

"Don't just change your batteries; change your smoke detector too," IAFF officials urged in an October announcement, in which they called for federal, state and local leaders to change building codes to require photoelectrics.

Coatesville, Philly share a goal

Nowhere is the issue more pressing than Coatesville, a city ablaze.

Firefighters in the 2-square-mile burg have responded to about 35 arsons since January 2008. As investigators scramble to determine who is setting the fires, some residents and experts say authorities should focus more on whether residents have smoke detectors effective enough to save them.
"The terror we still live through, watching everybody else's house burn up here - this is why I go through counseling, this is why I'm medicated," Wylie said. "It's like we relive our fire every time" the arsonists strike.
Still, many industry and fire-safety experts insist that ion alarms provide adequate escape time and warn that the debate could shake consumer confidence in smoke detectors.
"They all have their pros and cons," Coatesville Fire Chief Kevin Johnson said of the types of alarms. "But the bottom line here is that it's better to have any kind than none at all."
Johnson has stepped up efforts to install ion alarms in homes and businesses in the wake of the arson rampage.
"We have citizens, they don't have smoke alarms at all," added Philadelphia Fire Commissioner Lloyd Ayers. "So our first goal is to get everyone with smoke alarms. Two, to educate them what to do when the smoke alarms go off and plan with their family an escape plan. Then after that, we want to make sure that they practice that [escape plan] every once in a while. Whether it's ionization or photoelectric, I'm not concerned with that as much as I am first getting everyone in a safety frame of mind."
Kidde spokeswoman Heather Caldwell agreed: "The most important thing is to have a working smoke alarm in your home, regardless of the technology."
Fleming brushes off such logic.
"I'm not saying people should get rid of ionization alarms. They are better than nothing," Fleming said. "But it's like arguing that you don't need airbags in your car because you already have seat belts. We need to educate the public not only about the benefits of smoke detectors in general, but of photoelectrics in particular."
Fleming has at least one local supporter.
"He's correct, and he has the bodies to back it up, unfortunately," said Brian McBride, president of Local 22, the city firefighters' union.
McBride said he recently replaced ion alarms in his home and the homes of two of his grown children with photoelectric alarms.
"It's a small investment [to buy photoelectrics], and in these days of fire-company cuts and the increased response time they bring, you're going to want every bit of escape time you can get," McBride said.
But Ayers, who uses ion alarms in his home, said he won't push for photoelectrics until they're the national standard. While the National Fire Protection Association and the U.S. Consumer Product Safety Commission agree that photoelectrics are faster in smoldering fires, they also emphasize that both technologies allow enough escape time in most fires.
"When you hear about this debate, you say: 'Wait a minute, are we putting something out there that's not giving people enough time to get out?' But then we look at the data, the studies, the cost, and I think we can do the ionization until we find more compelling data that would make the whole country change [to photoelectrics]," Ayers said.
The Philadelphia Fire Department spends about $100,000 a year to put about 30,000 free ion alarms in city homes and businesses, Ayers said. A fourth of that money comes from the city, and corporate and philanthropic donations cover the rest, he said.
To switch to photoelectrics, "we'd need to double or triple that. But we want to get the most [alarms installed] that we can with the funds that we receive."

Class-action suit brewing

Still, Ayers and other fire chiefs might not have time to wait for government entities to change policies.
A Boston law firm filed a class-action suit last summer against Kidde and First Alert, alleging that the two companies have misled and imperiled citizens by not alerting them to problems with ion alarms.
The lawsuit could affect thousands of people.
In 2007, fires in 530,500 structures resulted in 3,000 deaths, 15,350 injuries and $10.6 billion in property damage, according to the National Fire Protection Association.
In Philadelphia, 39 people died in 20 fires last year, said Chief Daniel Williams, a fire spokesman. Smoke alarms were present and sounded in 10 of those blazes, while in another six, firefighters found detectors that either hadn't activated or had dead or no batteries, Williams added.
"Fire companies want to blame fire deaths on a lack of smoke detectors,

but half of your [Philadelphia's] fatal fires had working smoke detectors," Fleming said. "So do you see the problem there?"
Jessica Torres and Desiree Wylie do. At least now.
Before Sept. 21, they didn't know about more than one kind of smoke detector, or that theirs might not do what it was supposed to do. Although more than four months have passed, their heartache remains just as raw as the day they lost Brian, Tyrone and Tyzhier.
"I believe we all would have made it out, if we'd just had more time," Wylie said. "We might have lost the house, but we would have each other. The boys would still be here, and we would have had each other."

B.K.
FF/EMT
I'm sorry if you aren't pleased with my views. You're not paying me, so I'm not here to please you.

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02-14-2009 17:34 #2

Pudge40

Registered User - Junior Posting Member

Join Date: Jul 2008
Posts: 57

Rep Power: 0

Re: Ion or Photoelectric smoke detectors? You decide!

Another thing to point out is that it is reccomended that all detectors be replaced every 10 years. I don't know for sure if this is due to them becomming less sensitive or not.

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March 25 - 28, 2001
National Institute Of Standards and Technology
Gaithersburg, Maryland U.S.A.

PROCEEDINGS

Editors: Kellie Beall, William Grosshandler and Heinz Luck

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National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

J. R. Qualey III, L. Desmarais, J. Pratt
Simplex Time Recorder Co., 100 Simplex Drive, Westminster, MA 01441

Response-Time Comparisons of Ionization and Photoelectric/Heat Detectors

1. Introduction

Despite the recent introduction of new technologies, the vast majority of smoke detectors sold and in service today are based on either the photoelectric or the ionization principle. In the twenty-five years since smoke detectors began to attain widespread acceptance as essential life/safety fire protection devices [1], it has become generally accepted that "ionization smoke detection is more responsive to invisible particles (smaller than 1 micron in size) produced by most flaming fires" [2]. It is also generally accepted that photoelectric detection is "more responsive to visible particles (larger than 1 micron in size) produced by most smoldering fires", "somewhat less responsive to smaller particles typical of most flaming fires", and "less responsive to black smoke than lighter colored smoke" [2]. However, the relative merits of the two detector types continue to be a subject of discussion [3].

We recently reported the results of fire tests comparing the response time performance of three models of ionization smoke detector (from three different manufacturers) to a photoelectric smoke detector model [4]. As an extension of that work, we conducted an additional series of fire tests comparing the performance of two ionization detector models used in the earlier study to the performance of a single model of photoelectric/heat detector. The photoelectric/heat detector combines a thermistor-based heat detector with a photoelectric smoke detector which is otherwise identical to the model used in the earlier study. These series of fire tests are the latest in an ongoing investigation which Simplex is conducting to help develop objective criteria for which smoke detector technologies are most appropriate for different applications.

Consistent with the results of the earlier investigation comparing ionization smoke detectors to photoelectric detectors, the results reported here show that in UL 268 Smoldering Smoke tests, photoelectric detection occurred many minutes earlier than

ionization detection. The results also show that in UL 268 Flammable Liquid Fire tests and TF-5 type liquid heptane fire tests, photoelectric and ionization detection occurred at about the same time. The three heat detector modes evaluated (15 °F/min ROR, 20 °F/min ROR, and 135 °F fixed temperature) generally did not exceed their alarm thresholds in either the TF-5 type fire tests or the UL 268 Smoldering Smoke and Flammable Liquid Fire tests. However, the maximum rate-of-rise measured for the heat detectors in the TF-5 type tests suggest that the heat detection component would be useful for fires with a heat release rate (HRR) somewhat larger than that generated in the test.

2. Test Procedures

Two commercially-available ion smoke detectors were compared to a commercially-available photoelectric/heat detector which incorporates a thermistor-based heat detector. For each test, the basis of comparison was the response-time-difference between the ion detector under test and an adjacent photoelectric/heat detector. The comparisons were conducted using standardized test fires in Simplex's UL 268 Fire Test Room.

For each test series, six samples of the ion detector under test were surface mounted on the fire room ceiling. Four of the ion detectors were arranged in a 15-foot square array and two were placed in the right and left positions of the ceiling "Test Panel" specified by UL 268 [5] (ceiling positions Ion 5 and Ion 6 in Fig. 1). A photoelectric/heat detector was placed adjacent (approximately 6-in. separation) to each of the ion detectors in the square array. A fifth photoelectric/heat detector was mounted midway between the Ion 5 and Ion 6 ceiling positions. For each test, the distances from the detector locations to the test fire are given in the results table for that test (Tables 1 - 8). For all tests, each photoelectric, and ion detector was placed so that its "least favorable position for smoke entry" was oriented towards the test fire location.

Three different fire types were used to evaluate each ion detector model. The first test-type was the UL 268 "Smoldering Smoke Test" found in section 40 of UL 268. This test used 10 sticks of ponderosa pine (3" x 1" x ¾") on a laboratory hotplate to produce

a slow, smoldering fire. The second test-type was the UL 268 "Flammable Liquid Fire – Test C" found in section 39.4 of UL 268. This test used 38 milliliters of a mixture of 65% heptane and 35% toluene by volume to produce a hot, flaming fire. Both of these UL 268 fire tests were performed according to the test method outlined in UL 268, 4th Ed. paragraph 39.6. As specified in UL 268, photo beam and measuring ionization chamber (MIC) data were collected during all tests and analyzed to ensure that the buildup rate and the light-transmission vs. MIC curves conformed to the requirements of UL 268.

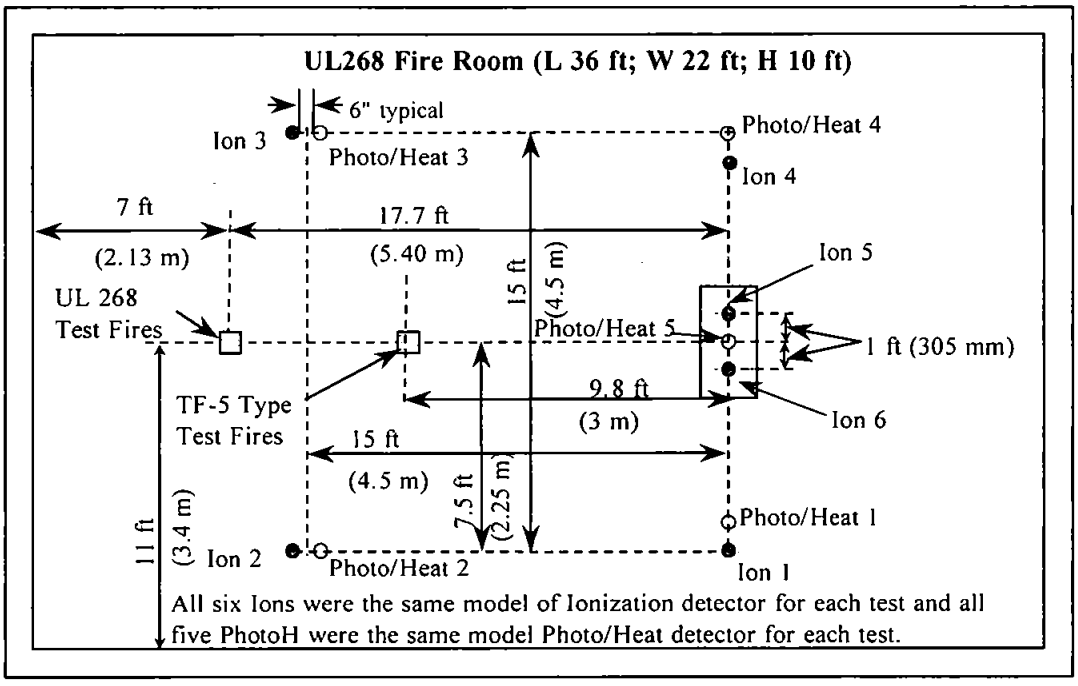

Figure 1. Detector Positions for Fire Tests

The third test type was similar to the "TF-5 - Liquid (Heptane) Fire" described in Appendix K of pr EN 54-7 (Draft A3). The ceiling of the UL 268 fire room is 1 meter less than that specified by prEN 54-7 so the amount of the heptane (97%)/toluene (3%) mixture was reduced to 463 ml to prevent heat and fire damage to our test facility. The fuel was burned in a round receptacle 33 cm in diameter and 7.5 cm deep to attain the required smoke density build-up rate. The test fire location was selected so that ceiling positions Ion 5, Ion 6, and Photo 5 were contained in the prEN-54-specified volume.

The fire room was instrumented with an NIR obscuration meter and MIC which met the prEN 54-7 criteria. Optical density (m-value in dB/m) and MIC data (y-value) were collected and analyzed for each test to determine if the "m against y" and "m against time" tolerance limits of prEN 54-7 were met. The TF-5 type fires typically came close to or met the tolerance limits as shown in Fig. 2.

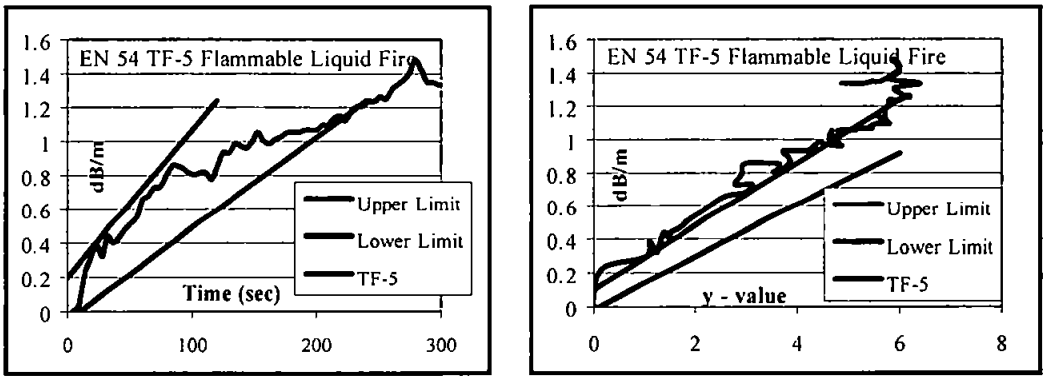

Figure 2. pr4EN 54-7 Fire TF-5 Tolerance Limits

3. Description of Devices Tested

Two ion sensor models from different manufacturers were tested. Ion detector Type A is currently sold by Simplex for use in Simplex fire alarm systems. Ion detector Type B was previously sold by Simplex for use in Simplex fire alarm systems. Each type of ion detector consists of a detector/base combination which sends a digital representation of smoke density to a Simplex control panel. The alarm activation time of each ion detector was evaluated at 0.5 %/ft (the most sensitive of its four standard settings) and at its default installation sensitivity of 1.3 %/ft. All six detectors of each ion type were selected at random from stock. Each ion detector was used as calibrated by its manufacturer.

The five photoelectric/heat detectors used were standard Simplex UL-listed units taken at random from stock. This detector type consists of a sensor/base combination which sends digital representations of smoke density and temperature to a Simplex control panel. The alarm activation time of the photoelectric component was evaluated at 0.5 %/ft (the most sensitive of its eight standard settings) and its default installation sensitivity of 2.5 %/ft. Each of the five photoelectric/heat detectors was calibrated in a

Simplex UL 268 Sensitivity Test Box using Simplex's standard manufacturing calibration procedure.

The thermistor-based heat sensor element of the photoelectric/heat detector is a fixed temperature/rate-of-rise type whose sensitivity can be selected at the control panel. In the present investigation, the alarm activation time of the heat detector component was evaluated using two rate-of-rise (ROR) sensitivities (15 °F/min and 20 °F/min) and one fixed-temperature (FT) sensitivity (135 °F). In addition, maximum ROR data for each heat detector component was collected for each TF-5 type test

4. Data Collection

In each test, a digital representation of each ion and photoelectric/heat detector's output voltage was transmitted to a PC-based data acquisition system. Ion, photoelectric, and heat detector response times were calculated by post-processing the data. The algorithms used, together with a 4 second polling interval and alarm thresholds based on the device calibration, simulated the performance of the Simplex Model 4010 fire panel operating with no pre-alarm and no alarm verification delay. A chief advantage of using this method for obtaining detector response times was that it enabled the determination of detector response times at multiple sensitivities during a single test fire, thus decreasing the total number of test fires. For each combination of ion detector type and test fire type, four trials were conducted.

The ion and photoelectric detectors were compared at two combinations of sensitivity levels. The comparison at the same sensitivity of 0.5 %/ft was selected because these are the most sensitive standard Simplex sensitivities of these two detector types. The comparison of the ion detector at 1.3 %/ft to the photoelectric detector at 2.5 %/ft was selected because these are the default sensitivities of these two detector types and therefore represent a typical Simplex installation.

5. Fire Test Results

The results for the comparison of ion detector Type A and the photoelectric/heat detector are summarized in Tables 1 - 4. Unless otherwise noted, each alarm time entry

is the average of 4 trials. The detector positions are indicated in parentheses beneath the distance from the fire. Note that, for each test type, only one average photoelectric alarm time is listed for ceiling positions 5 and 6. This is because the ion detectors at ceiling positions 5 and 6 were compared to a single photoelectric detector midway between them at ceiling position 5. For the smoldering smoke tests, the individual Type A ion and photoelectric detector response times measured for the four trials generally varied over a range of a few hundred seconds at each ceiling position. For the UL 268 Flammable Liquid Fire and the TF-5 type tests, the range of variation was on the order of ten seconds. Each table includes the difference between the average response times of the ion and photoelectric detectors for each ceiling position.

The average response-times recorded for the Type A ion detector at 1.3 %/ft and the photoelectric/heat detector at 2.5 %/ft are listed in Table 1 for the UL 268 Smoldering Smoke and Flammable Liquid Fire tests. Note that not all ion detectors alarmed in each smoldering smoke test. For each ion detector position, the number of tests for which no alarm (N/A) was observed is indicated in parentheses beneath the average response time value. Table 2 lists the average response-times of the ion and the photoelectric detectors in the UL tests when both were set to a sensitivity of 0.5 %/ft.

UL 268 Tests **Ionization Type A: 1.3 %/ft** **Photoelectric: 2.5 %/ft**		**Distance from Test Fire** **(Ceiling Position #)**					
		8.0 ft		**17.7 ft**		**19.2 ft**	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)**	**(1)**	**(4)**
UL 268 Smold. Smoke Averages of 4 Trials	Ion A (N/A)	3459	3317	3843 -(3)	3614	3864 (2)	3591
	Photo	2421	2253	2916		2726	2823
Diff. of Avg. Time (Ion - Photo)		1038	1064	927	698	1138	768
UL 268 Flamm. Liquid	Ion A	31	36	61	56	65	65

	Photo	26	29	55		57	57
Diff. of Avg. Time (Ion - Photo)		5	7	6	1	8	8

Table 1. Ion Detector A, UL 268 Tests: Default Sensitivity Alarm Times (in sec.)

The data for the smoldering smoke tests show that typically the photoelectric detectors set to 2.5 %/ft responded 12 - 18 minutes earlier than the Type A ion detectors set to 1.3 %/ft. Table 2 shows that when both were evaluated at 0.5%/ft, the photoelectric detectors typically responded 25 - 30 minutes faster than the Type A ion detectors. As Tables 1 and 2 show, in the UL 268 Flammable Liquid Fire tests, there was no significant difference in response time between the photoelectric and Type A ion detectors whether compared at their default sensitivities (2.5 %/ft and 1.3 %/ft) or the same, higher sensitivity (0.5 %/ft).

UL 268 Tests Ionization Type A: 0.5 %/ft Photoelectric: 0.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		8.0 ft		17.7 ft		19.2 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)**	**(1)**	**(4)**
UL 268 Smold. Smoke	Ion A	3318	3236	3691	3471	3677	3474
Averages of 4 Trials	Photo	1556	1577	2008		1854	2002
Diff. of Avg. Time (Ion - Photo)		1762	1659	1683	1463	1823	1472
UL 268 Flamm. Liquid	Ion A	29	31	60	56	65	63
Averages of 4 Trials	Photo	18	20	45		53	52
Diff. of Avg. Time (Ion - Photo)		11	11	15	11	12	11

Table 2. Ion Detector A, UL 268 Tests: 0.5 %/ft Sensitivity Alarm Times (in sec.)

TF-5 Type Tests Ionization Type A: 1.3 %/ft Photoelectric: 2.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		9.1 ft		9.8 ft		12.3 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)***	**(1)**	**(4)**
Modified TF-5 Fire	Ion A	19	20	26	22	38	32
Averages of 4 Trials	Photo	55	58	69		76	67
Diff. of Avg. Time (Ion - Photo)		-36	-38	-43	-47	-38	-35
Max ROR result (°F/min. Avg. of 4 trials)	ROR	14	7	14		12	10
Max. Temperature (°F. Avg. of 4 trials)	FT	115	89	114		101	99

Table 3. Ion Detector A, TF-5 Type Tests: Default Sensitivity Alarm Times (in sec.) Maximum ROR and Fixed Temperature Values

Table 4 lists the average response times in the TF-5 type tests of the Type A ion detectors evaluated at 1.3 %/ft and the photoelectric detectors evaluated at 2.5 %/ft. Table 4 lists the average response times in the TF-5 type tests of the ion and the photoelectric detectors when both were set to a sensitivity of 0.5 %/ft. In the TF-5 type tests, Type A ion detectors evaluated at 1.3 %/ft responded in 19 to 38 seconds; about 40 seconds faster than the photoelectric detectors set at 2.5 %/ft. When the sensitivity levels were set to 0.5 %/ft for both types, there was no significant difference in TF-5 test response time between the photoelectric and Type A ion detectors. It is interesting

to note that in both the UL 268 Flammable Liquid Fire tests and the TF-5 type tests, there were no significant differences in the Type A ion detector alarm times whether set at 0.5% or 1.3 %/ft.

TF-5 Type Tests **Ionization Type A: 0.5 %/ft** **Photoelectric: 0.5 %/ft**		**Distance from Test Fire (Ceiling Position #)**					
		9.1 ft		**9.8 ft**		**12.3 ft**	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)***	**(1)**	**(4)**
Modified TF-5 Fire	Ion A	16	19	24	22	35	30
Averages of 4 Trials	Photo	15	17	19		23	23
Diff. of Avg. Time (Ion - Photo)		1	2	5	3	12	7

Table 4. Ion Detector A, TF-5 Type Tests: 0.5 %/ft Sensitivity Alarm Times (in sec.)

The results for the comparison of ion detector Type B and the photoelectric/heat detector are summarized in Tables 5 - 8. Each alarm time entry is the average of 4 trials. For the four smoldering smoke tests, the response times measured for the individual Type B ion and photoelectric detectors generally varied over a range of a few hundred seconds at each ceiling position. For the UL 268 Flammable Liquid Fire and the TF-5 type tests, the range of variation was on the order of ten seconds.

The average response-times recorded in the UL 268 Smoldering Smoke and Flammable Liquid Fire tests for the Type B ion detector at 1.3 %/ft and the photoelectric/heat detector at 2.5 %/ft are listed in Table 5. Table 6 lists the average response times of the ion and the photoelectric detectors in the UL tests when both were set to a sensitivity of 0.5 %/ft. The data for the smoldering smoke tests show that the photoelectric detectors set to 2.5 %/ft responded 8 - 14 minutes earlier than the Type B ion detectors set to 1.3 %/ft. When both were evaluated at 0.5%/ft, the photoelectric detectors typically responded 17 - 25 minutes faster than the Type B ion detectors. In the UL 268 Flammable Liquid Fire tests, there was no significant difference in response time between the photoelectric and Type B ion detectors whether compared at their default sensitivities (2.5 %/ft and 1.3 %/ft) or the same, higher sensitivity (0.5 %/ft).

UL 268 Tests Ionization Type B: 1.3 %/ft Photoelectric: 2.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		8.0 ft		17.7 ft		19.2 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)**	**(1)**	**(4)**
UL 268 Smold. Smoke	Ion B	3350	3368	3470	3518	3602	3553
Averages of 4 Trials	Photo	2566	2534	3008		2871	2970
Diff. of Avg. Time (Ion - Photo)		784	834	462	510	731	583
UL 268 Flamm. Liquid	Ion B	25	22	50	50	56	55
Averages of 4 Trials	Photo	29	32	56		58	58
Diff. of Avg. Time (Ion - Photo)		-4	-10	-6	-6	-2	-3

Table 5. Ion Detector B, UL 268 Tests: Default Sensitivity Alarm Times (in sec.)

Table 7 lists the average response times in the TF-5 type tests of the Type B ion detectors evaluated at 1.3 %/ft and the photoelectric detectors evaluated at 2.5 %/ft. Table 8 lists the average response-times of the ionization and the photoelectric detectors in the UL tests when both were set to a sensitivity of 0.5 %/ft. The Type B ion detectors evaluated at 1.3 %/ft responded in 19 to 27 seconds in these tests; about 45 seconds faster than the photoelectric detectors set at 2.5 %/ft. When the sensitivity levels were evaluated at 0.5 %/ft for both types, there was no significant response-time-difference between the photoelectric and Type A ion detectors. For both the UL Flammable Liquid Fire tests and the TF-5 type tests, there were no significant differences in the Type B ion detector alarm times whether set at 0.5% or 1.3 %/ft .

UL 268 Tests Ionization Type B: 0.5 %/ft Photoelectric: 0.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		8.0 ft		17.7 ft		19.2 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)**	**(1)**	**(4)**
UL 268 Smold. Smoke	Ion B	3159	3211	3340	3343	3450	3395
Averages of 4 Trials	Photo	1676	1697	2331		1929	2198
Diff. of Avg. Time (Ion - Photo)		1483	1514	1009	1012	1521	1197
UL 268 Flamm. Liquid	Ion B	21	21	49	48	55	54
Averages of 4 Trials	Photo	19	18	49		55	49
Diff. of Avg. Time (Ion - Photo)		2	3	0	-1	0	5

Table 6. Ion Detector B, UL 268 Tests: 0.5 %/ft Sensitivity Alarm Times (in sec.)

The heat detector fixed temperature and ROR functions generally did not exhibit a significant response in the UL 268 Smoldering Smoke and UL 268 Flammable Liquid fire tests. In the TF-5 type fire tests, the fixed temperature and ROR functions did not generally exceed their alarm thresholds, but, these quantities reached significant levels which are tabulated in Tables 3 and 7 for the Type A ion tests and Type B ion tests, respectively.

TF-5 Type Tests Ionization Type B: 1.3 %/ft Photoelectric: 2.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		9.1 ft		9.8 ft		12.3 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)**	**(1)**	**(4)**
Modified TF-5 Fire	Ion B	19	21	20	20	27	26
Averages of 4 Trials	Photo	67	58	72		71	65
Diff. of Avg. Time (Ion - Photo)		-48	-37	-52	-52	-44	-39
Max ROR result (°F/min. Avg. of 4 trials)	ROR	9	7	13		13	10
Max. Temperature (°F Avg. of 4 trials)	FT	100	93	115		106	104

Table 7. Ion Detector B, TF-5 Type Tests: Default Sensitivity Alarm Times (in sec.); Maximum ROR and Fixed Temperature Values

TF-5 Type Tests Ionization Type B: 0.5 %/ft Photoelectric: 0.5 %/ft		Distance from Test Fire (Ceiling Position #)					
		9.1 ft		9.8 ft		12.3 ft	
Test	**Device**	**(2)**	**(3)**	**(5)**	**(6)***	**(1)**	**(4)**
Modified TF-5 Fire	Ion B	16	17	18	17	23	23
Averages of 4 Trials	Photo	16	18	16		25	23
Diff. of Avg. Time (Ion - Photo)		0	-1	2	1	-2	0

Table 8. Ion Detector B, TF-5 Type Tests: 0.5 %/ft Sensitivity Alarm Times (in sec.)

6. Discussion: Photoelectric/Heat vs. Ion Response

A series of UL 268 Smoldering Smoke (gray smoke), UL 268 Flammable Liquid Fire (black smoke), and TF-5 type Liquid (Heptane) Fire (black smoke) tests were conducted to compare the performance of two models of commercially available ion detectors (designated Type A and Type B) to the performance of a commercially available photoelectric/heat detector. The basis of comparison was the length of time required for each detector to exceed its alarm threshold.

In the smoldering smoke tests, at both combinations of sensitivity tested, both models of ion detector took considerably longer to respond than the photoelectric component of the photoelectric/heat detectors. This result strongly supports the generally accepted view [2] that photoelectric detector technology possesses an advantage over ion detector technology with regards to smoldering smoke response.

In the UL 268 Flammable Liquid Fire tests, the performance of the photoelectric component of the photoelectric/heat detector was fully equivalent to that of both ion detector models at both combinations of sensitivity. The detectors of all three types typically alarmed in about a minute or less.

In the TF-5 type tests, the ion detectors (both types) responded about 40 - 45 seconds earlier than the photoelectric detectors when both technologies were evaluated at their default sensitivities (2.5 %/ft for the photoelectric and 1.3 %/ft for the ions). In Figure 3, the 8-bit digital representation of smoke density is plotted versus time for an ion detector and an adjacent photoelectric detector for typical UL 268 Flammable Liquid Fire and TF-5 type tests. The 0.5 and 1.3 %/ft alarm thresholds of the ionization detectors are indicated by dashed lines. Solid lines indicate the 0.5 and 2.5 %/ft photoelectric alarm thresholds of the photoelectric/heat detectors. In the UL 268 Flammable Liquid Fire tests, ion and photoelectric technologies responded approximately at the same time. In the TF-5 type fires, the photoelectric detectors generally responded more slowly than they did in the UL 268 Flammable Liquid Fire tests. The ion detectors took about the same length of time in both types of fire. The slower performance of the photoelectric detectors in the UL 268 Flammable Liquid Fire tests is possibly due to the fuel mixtures used. In the TF-5 fire, the heptane fuel (smoke yield .037 g/g) contains only 3% toluene (smoke yield .178 g/g) [6]. It seems likely, therefore, that the 65% heptane/35% toluene fuel mixture used in the UL 268 Flammable Liquid Fire test will produce a greater proportion of visible smoke than the TF-5 fire. Since ion detectors have a greater sensitivity to the invisible particles produced by a hot flaming fire, the conditions of the TF-5 type fire would therefore be more favorable for ion detectors than the UL 268 Flammable Liquid Fire test.

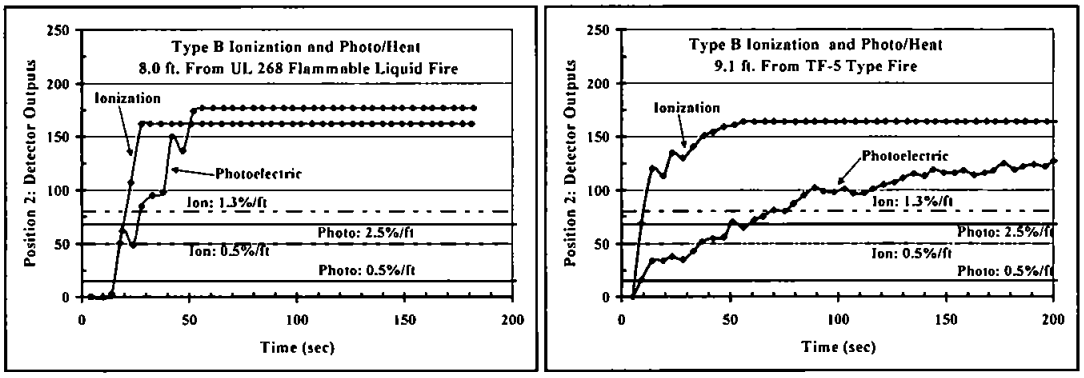

Figure 3. Detector Outputs for TF-5 and UL 268 Flammable Liquid Fire Tests

With the 4 second sample time used, the two technologies yield equivalent response times of about 20 seconds at the higher sensitivity of 0.5 %/ft. At the lower default sensitivities (1.3 %/ft for the ion, 2.5 %/ft for the photo), the faster response of the ion detector to the TF-5 fire products becomes more obvious. This interesting result illustrates the importance of fully specifying the experimental conditions when performing technology comparisons.

The three heat detector modes evaluated (15 °F/min ROR, 20°F/min ROR, and 135 °F fixed temperature) generally did not exceed their alarm thresholds in the fire tests performed. Furthermore, the response of the fixed temperature and ROR functions, though negligible in the UL 268 Smoldering Smoke and Flammable Liquid Fire tests, was significant in the TF-5 type tests. For example, the ROR heat detection function came relatively close to alarming at the 15 °F/min setting in the TF-5 fire tests. Two factors probably contribute most to this performance differential. First, in the TF-5 type tests, all detectors were closer to the fire than in the two UL 268 tests. Second, the heat release rate (HRR) of the TF-5 type test was much greater than for either UL 268 test. Using the heat release rate (HRR) calculation described in the SFPE Handbook [7], the HRR of the TF-5 type fire was estimated to be 123 kW and the HRR of the UL 268 Flammable Liquid Fire test was estimated to be 12.7 kW. The HRR of the UL 268 smoldering fire was estimated to be about 1.5 kW, based on the hotplate characteristics.

7. Conclusions

In this investigation, the response of the photoelectric smoke detection technology to

smoldering smoke was much faster than the response of the ion technology. The photoelectric response to the black smoke produced by the UL 268 Flammable Liquid Fire was generally as fast as (or faster than) the ion response. In the TF-5 type fire tests, the photoelectric response lagged the ion response by only about 45 seconds when both were evaluated at their default sensitivities (1.3 %/ft for ion, 2.5 %/ft for photoelectric). However, the photoelectric response to the TF-5 type fire was typically as fast as the ion response when both were evaluated at the same sensitivity (0.5 %/ft). Furthermore, the TF-5 type fire test results also indicate that, even in the absence of visible smoke, the photoelectric/heat detector would be effective for the detection of fires with a heat release rate or duration slightly greater than that of the TF-5 type test fire used. Therefore, these results strongly support the conclusion that photoelectric and photoelectric/heat technologies possess a clear overall performance advantage over ion technology if the most likely sources of fire danger are smoldering fires (as some believe [3]) or flaming hydrocarbons.

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