MARYLAND SMOKE ALARM TECHNOLOGY TASK FORCE

Final Report

Exploring Changing Technologies to Improve Residential Smoke Alarm Performance

August 2012

MARYLAND SMOKE ALARM TECHNOLOGY TASK FORCE

August 30, 2012

William E. Barnard
State Fire Marshal
1201 Reisterstown Road
Pikesville MD 21208

Dear Fire Marshal Barnard,

We are pleased to submit for your review, the final report of the ***Maryland Smoke Alarm Technology Task Force***. As directed by you, the Task Force has thoroughly investigated and researched every facet of smoke alarm operation, function and failure, as well as new and emerging technologies in an effort to develop the recommendations contained in these pages to best protect the citizens of Maryland.

Since the creation of the Task Force we have conducted 20 formal meetings and numerous sub-committee meetings. We have heard from individuals, associations and corporations outside of the Task Force membership in the form of oral presentations and written comment. We have also relied on the strong base of knowledge contained within the Task Force members and their organizations.

The Task Force has sincerely appreciated the opportunity to serve you as well as the citizens of Maryland and urge you and other leaders to give the highest priority to the recommendations contained herein.

Sincerely,

Matthew W. Kelleher, Chairman
Maryland Smoke Alarm Technology Task Force

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EXECUTIVE SUMMARY

Properly installed and maintained Residential Smoke Alarms have an established record of saving lives for nearly half a century. Despite these successes, the United States continues to experience thousands of lives lost in residential fires where smoke alarms fail to operate or were not present. Of these, the most common cause of inoperable smoke alarms has been a dead or missing battery. (ref.1)

At the request of the Maryland State Fire Marshal, the *Maryland Smoke Alarm Technology Task Force* has spent the last two years reviewing smoke alarm data from residential fires reported throughout the state whether or not they included loss-of-life. This effort was intended to determine the best strategy to reach a goal of reducing residential fire deaths in Maryland. The major focus of the *Task Force* has been to review changing and emerging technologies to determine if better smoke alarms exist that can help reach that goal.

The *Task Force* acknowledges smoke alarms will not prevent every fire fatality. The very young, the very old, those with physical or cognitive mobility impairments and those in the room of fire origin need other measures such as residential fire sprinklers to increase their chance of survival. (ref.2) Nothing in this report should be interpreted to suggest that smoke alarms are an adequate substitute for residential automatic sprinkler protection. The success or failure of smoke alarms to properly operate and therefore save lives is largely dependent on the action or inaction of the occupant at some point before the fire occurs.

The lack of installing, testing, maintaining and timely replacement of these simple electronic devices continually leads to tragic consequences. Two out of every three residential fire deaths in Maryland occurred without a working smoke alarm present; either no smoke alarms installed or the installed alarms were inoperable. (ref. 3) Some of the best technological improvements have been made in the area of power supply for battery-only operated units that still protect the majority of homes in the United States. Exploiting this one area of improvement could go far in reducing the number of smoke alarms which fail to operate due to dead or missing batteries. This is just one of the recommendations forwarded to the *Maryland State Fire Marshal* and is included below:

Summary of Recommendations:

● Whenever a “battery only” smoke alarm is permitted to be used, the alarm shall be the type that contains a long life sealed battery as its power source.

● All smoke alarms, no matter their power source, shall contain the hush/silence feature to allow the device to reset automatically after a period of time.

● Organize a standing *“Smoke Alarm Advisory Committee*” which will continue to review changing technologies and how best to incorporate smoke alarm improvements into current technologies through education and code change.

● Improve smoke alarm packaging to better identify power requirements, type, manufacture and replacement dates, as well as provide better graphics on the alarms themselves.

● Educate fire/rescue personnel on the differing smoke alarm requirements based on age of the home as well as newer smoke alarm features such as long life batteries and hush/silence buttons.

● Require all fire departments and other organizations that operate smoke alarm programs for residents to use alarms with long life-sealed batteries when battery only smoke alarms are provided.

● Require all jurisdictions within the State to adopt the International Residential Code (IRC) pertaining to the upgrading of smoke alarms in homes when any permit for work is applied for.

● Require the installation of smoke alarms in all bedrooms and on every level of existing homes.

● Require that when a home is sold it is provided with the proper smoke alarms appropriate to when the home was built or last remodeled.

● Advocate for code change (NFPA 720 and NFPA 72) to better identify the alarm caused by smoke as distinguished from the alarm sound caused by carbon monoxide. (T3-T4, voice, visual signal)

● Implement an easy to use website (*mdlifesafety.org*) that will address many of the questions and myths that homeowners have about their smoke alarms.

● Implement the effective use of Internet-based multi-media to facilitate community outreach in order to maximize dissemination of information to State residents:

- Web site
- Facebook
- Twitter

The key to saving lives, especially those not intimate to the fire, is early warning and escape time. Substantive changes over the past 40 to 50 years in home design, construction materials, contents and furnishings have resulted in dramatically increased fire growth rate and attendant reduction in available time for safe egress. The fire must be recognized quickly and notification of the event must be transmitted to those in danger to increase their chances of survival. *Available Safe Egress Time* (ASET) is the slim window of opportunity after notification that must be exploited to offer the best chance of survival. (ref. 4) Multiple correctly placed operating smoke alarms that are interconnected provide the best chance of early notification thereby increasing the ability to escape a residential fire.

The media continue to report tragic fire events and many of these conclude with the same sad ending. The absence of smoke alarms or those with dead or missing batteries seal the fate of those inside the fire-involved structure. Cultural/behavioral change must occur in order to recognize that the most important piece of electronics a family owns is the one they walk underneath every day. Education concerning the newest features and latest requirements of smoke alarms while emphasizing the importance of proper installation and maintenance is paramount. ***Technology will serve no one without proper application.***

There has been much discussion regarding whether ionization or photoelectric smoke alarms provide the best protection in residential dwellings. The *Task Force* spent many hours reviewing reports, witnessing presentations and researching data on the operation of all types of smoke alarm technologies. It was clear to all members of the *Task Force* that both types of alarms, when properly installed and maintained, consistently provide adequate warning and increased time for a family to escape most residential fires. More importantly, the *Task Force* was quite concerned with jurisdictions that may be limiting themselves to only one kind of technology while

simultaneously advancements are continuing in the field of smoke recognition and warning. The recommendation to organize a standing smoke alarm advisory committee was born out of these very concerns.

Over the course of 20 formal meetings as well as many other informal meetings and work sessions, the *Maryland Smoke Alarm Technology Task Force* received and reviewed a wealth of technical information. This information was assembled from a combination of oral presentations and written reports from individuals representing organizations involved in the design, manufacture, approval and code acceptance of smoke alarms intended for protection in residential occupancies. Concurrent with the work of this Task Force, similar groups in a number of other states were involved in the same kind of smoke alarm technology review. Although these groups assembled material from many sources, the fact that they all arrived at similar, and often identical, conclusions is notable because they worked independently of one another. More than that, the congruence of the conclusions of these individual groups confirms the validity of all of their conclusions. Worth mentioning here are the reports of three such groups, which all reached similar conclusions and recommendations: the *Maryland Smoke Alarm Technology Task Force*, *CAL FIRE – Office of the State Fire Marshal,* the *California State Fire Marshal Smoke Alarm Task Force Final Report* August 2011 and Ohio State Fire Marshal – Ohio Department of Commerce, the *Recommendations Report Ohio Smoke Alarm Advisory Task Force, April 2012*

There will always be residential fires. The frustration felt by this Task Force is no different from many of those reading this report. For the most part, a few simple steps can greatly improve life safety. We only hope, as our technology continues to improve, we embrace and exploit these changes to the fullest in order to save as many lives as possible.

*(ref 1) Aherns M, *"Smoke Alarms in US Home Fires"* Sept. 2011

*(ref 2) Milke, J, *"Performance of Smoke Detectors and Sprinklers in Residential and Health-Care Occupancies"* May 2010

*(ref 3) *OSFM "Fire Deaths in Maryland; 2011*" February 2012

*(ref 4) Mealy C, Gottuk D, "*Smoke Alarm Response: Estimation Guidelines and Tenability Issues"*-Part 1 & 2

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SUMMARY OF MEETING DATES, TOPICS AND PRESENTATIONS

The *Maryland Smoke Alarm Technology Task Force* was formed at the request of the State Fire Marshal to explore changing technologies within the smoke alarm industry and see if improvements in smoke alarms could further reduce fire fatalities in residential structures. At the March 2010 meeting of the *Maryland Fire Marshal Sub-Cabinet* a motion was made to develop such a task force.

The first meeting of the Task Force was held in April of 2010. At this meeting the groundwork began to lay out just what the scope and mission of the Task Force was to be. Information, as much as could be ascertained and gathered from as many sources possible was needed to assure that future recommendations derived from the Task Force were based on the latest technology and supported by scientific fact. To accomplish this, requests for information were sent to manufacturers, educational institutions and other organizations involved in smoke alarm research. The response to our request was extraordinary. Many documents were received involving current research being conducted in the field of measuring, analyzing and identifying products of combustion in order to provide the best possible device to accurately determine the existence of deadly smoke and fire. A number of these organizations provided presentations to the *Task Force* to better understand the changes that were occurring in the science of smoke development and alarm technology. They included:

- July 2010 Ron Lazarus, President, Eric Gonzalas, PE & Wendy Gifford
  - USI Electric
  - *" IOPHIC Universal Sensing Technology, an Introduction"*

- October 2010 Tom Sri, Government Affairs Manager,
  - Kidde Corporation
  - *" Providing Smoke Detection in a Changing World"*

- February 2011 Daniel Gottuk, P.E. Christopher Mealy, P.E.
  - Hughes & Associates
  - *"Smoke Detector Response and Tenability"*

- April 2011 Nicholas Belivia, Vice President,
  - BRK/First Alert
  - *"The Direction of Smoke Alarms in the Future"*

- June 2011 Thomas Cleary, Chemical Engineer,
  - National Institute of Science and Technology
  - *"An Analysis of the Performance of Smoke Alarms"*

- September 2011 Larry McKenna, Fire Protection Engineer
  - United States Fire Administration
  - "*Technologies for Residential Fire Detection*: *A Roadmap to* Third Generation Smoke Alarms"

- October 2011 Wayne Powell, Life Safety Specialist
  - Marriot Corporation
  - *"Fire Protection & Life Safety Design in Hotel Suites"*

HISTORICAL PERSPECTIVE

In the historic report “American Burning”, issued in 1973, one of the findings was: “The Commission urges Americans to protect themselves and their families by installing approved early warning fire detectors and alarms in their homes.”

The report entitled “Fire Detection and Life Safety” published in 1977 by the National Academy of Sciences stated the following:

> “The use of automatic fire detection for fire safety would appear to be reasonably recent, perhaps dating from 1950 or thereabouts.... The use of smoke detectors for life safety is much more recent... Three types of fire detectors are most commonly used in this country. These are known by the generic terms of heat detectors, smoke detectors and flame detectors. Only heat and smoke detectors appear to have application to the household fire detection system”

Heat detectors may be of the type that sense temperature of the environment, rate of rise of the environment temperature, or a combination of these. Since the primary purpose of early detection and warning in residential occupancies is life safety, the use of heat detectors is substantially limited. In the late 1950’s, self-contained non-electrical fire alarm units were being sold door-to-door. A unit of this type consisted of a heat detector... a horn or bell to sound the alarm and a source of stored energy... Because these units respond only to a temperature rise, they are intended for use in areas where a fire producing a great deal of heat is likely to occur, such as near a furnace, but they have also been employed throughout other rooms in the home. Hard sell techniques were employed in marketing these units...

In order to be of value in providing life safety, a fire detection system must make provision for detecting a small smoldering fire soon enough that alarm can be given and the building evacuated before untenable smoke conditions are reached. In addition, but of less relative importance, the fire detection system ought to be capable of early detection of rapidly developing hot fires.

Smoke detectors of the photoelectric and ionization types provide means for detecting smoke from either type of fire; and the most critical factor in

determining the speed of response is the location of the detector. Heat detectors, on the other hand, provide early warning of hot fires in their immediate area only.

The most favorable locations for smoke detectors, which protect the bedroom area, either alone or in conjunction with detectors located throughout the house, depend of course upon the building configuration. In general, the smoke detectors should be located so that smoke from any fire which originates outside of the bedroom area must pass over the smoke detector before entering the bedrooms.

Smoke detectors of two different types are available. Optical detectors are designed to sense the scattering of a light beam by smoke particles; combustion products detectors are designed to detect the presence of particulate products of combustion by electrical means...Each detector type has advantages and disadvantages associated with any particular application.

Provisions of Codes

Since 1967, NFPA 74, *Standard for the Installation, Maintenance, and Use of Household Fire Warning Equipment* specified the installation of a smoke alarm outside of the bedroom areas in residential occupancies. While this requirement existed, little, if any, "real life" application occurred since a "standard" only tells "how to do something". What is needed is for the installation of smoke alarms to be mandated by the "codes". In other words, the "codes" would mandate that smoke alarms be installed in accordance with the "standard". The National Commission on Fire Prevention and Control recommended in 1973 that "...all model codes specify that at least single-station-early-warning detector oriented to protect the sleeping areas in every dwelling unit".

The *BOCA Basic Building Code* (later known as the *BOCA National Building Code*), which was used in the State of Maryland, first incorporated such a requirement in the 1975 edition. This code required that "within buildings of use groups R-2 (residential, multi-family) or R-3 (residential, one- and two-family), each dwelling unit shall be provided with a minimum of one (1) approved smoke detector sensing visible or invisible particles of combustion installed in manner and location approved by the authority having jurisdiction. When activated, the detector shall provide an alarm audible to warn occupants within the individual dwelling unit."

The provisions of the BOCA codes were continually updated through the years until replaced with the *International Building Code* (IBC).

International Building Code

The International Code Council was formed by a combination of the three legacy code groups: Building Officials and Code Administrators (BOCA), Standard Building Code Congress (SBCC), and International Conference of Building Officials (ICBO), and developed the *International Building Code* (IBC). The first edition of this code became available in 2000. As of the writing of this report, the current edition is 2012.

The *International Building Code* specifies that single- or multiple-station fire alarms must be installed in all sleeping rooms of hotels, motels and lodging and rooming houses; and outside of and in all sleeping rooms in apartments, dormitories, one- and two-family dwellings, and board and care facilities. Alarms must receive the primary power from the building wiring system and also be provided with battery back-up power supply. Smoke alarms inside each living unit must be “interconnected”.

The International Code Council also publishes the *International Fire Code* (IFC) *International Residential Code* (IRC) and the *International Property Maintenance Code* (IPMC) all of which contain requirements for the installation of smoke alarms in residential occupancies consistent with the IBC.

While the provisions of the IBC are generally applied to “new” construction, the provisions of the IFC and IPMC are applicable to both new and existing construction. The provisions of the IRC are generally applied to new construction however, the IRC specifies that when alterations, repairs or additions requiring a permit are conducted, the dwelling must be brought into compliance with the requirements for new construction with regard to smoke alarms. Exceptions are provided for work involving exterior surfaces (roofs, siding, windows), plumbing and mechanical work and the addition of a porch or deck.

The provisions of the IPMC also require that smoke alarms be installed immediately outside all sleeping rooms, in all rooms used for sleeping purposes, and each level of a residential type occupancy.

Life Safety Code

The provisions of the "building codes" are generally applied only to "new" construction. The requirements are generally applied to "existing" buildings only when an addition, alteration, or renovation takes place. Establishing smoke alarm requirements for not only "new" construction but for retrofitting "existing" occupancies is contained within the scope of NFPA 101 known as the *Life Safety Code*. This Code establishes that its requirements apply to both new and existing construction and in various chapters there are specific requirements for existing buildings that might differ from those for new construction. In establishing the requirements the code sets forth, the code endeavors to avoid requirements which involve unreasonable hardships or unnecessary inconvenience or interference with the normal use and occupancy of a building, but provides for fire safety consistent with the public interest.

Smoke alarm requirements were first contained in a Tentative Interim Amendment (TIA) to the 1973 edition of the *Life Safety Code*. The National Fire Protection Association (NFPA) issues a TIA, when a matter is considered too important or critical to await the next regular revision cycle. The TIA is tentative because it has not been processed through the entire standards-making procedure. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a proposal of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards- making process.

The TIA provided that an approved smoke alarm (detector) be installed in the living unit of all new and existing apartments and all new and existing dwelling units (one and two family dwellings).

Smoke alarm requirements were further incorporated in the 1976 edition of the *Life Safety Code* in various sections. For both new and existing apartments, and lodging and rooming houses, a smoke alarm, powered by the house electrical service, was required to be installed within every living unit in the hallway or area leading to the sleeping rooms. In new one- and two-family dwellings, at least one smoke alarm, powered by the house electrical service, was required to be installed. For existing construction, battery-powered smoke alarms were permitted.

The 1976 edition of this code contained no requirements for hotels, motels, and dormitories. Requirements for these occupancies were added in the 1985 edition of the

Life Safety Code. For these occupancies, a smoke alarm, powered by the building electrical service, was required in all new and existing sleeping rooms.

Like all previous editions of the *Life Safety Code*, the 2012 edition contains requirements for both new and existing buildings. For hotels, motels, and dormitories, smoke alarms are required in every guest room and living area, and every sleeping room within a guest suite. In new construction, alarms must receive their primary power from the building electrical service and also be provided with a battery backup. Existing alarms powered solely by the building electrical service may remain in existing construction.

For apartments, a smoke alarm is required in every sleeping room, in the hallway or area leading to the sleeping rooms and on all levels, including basements. In new construction, alarms must be "interconnected" and be provided with both AC and battery backup power. In existing construction, alarms powered solely by the building electrical service may remain. Alarms may be eliminated from the sleeping rooms if the building is protected by residential or quick response sprinklers.

For lodging and rooming houses, a smoke alarm must be installed within each sleeping room. In new construction, the alarms must be provided with both AC and battery back up power. In existing construction, alarms powered solely by the building electrical service may remain.

In all one- and two-family dwellings, alarms must be installed in the hallway or area leading to the sleeping rooms and on all levels, including basements. In new construction, alarms must also be installed within each sleeping room. In new construction, alarms must be "interconnected" and be provided with both AC and battery backup power. Alarms powered solely by the building electrical service, and in certain instances by battery, are permitted to remain in existing buildings.

Manufactured Homes

The 1973 edition of the National Fire Protection Association *Standard for Mobile Homes,* designated NFPA 501B, required the installation of a smoke alarm immediately outside of each sleeping area. NFPA 501B was discontinued when the regulation of the construction of mobile homes was placed under the jurisdiction of the United States

Department of Housing and Urban Development (HUD), effective June 1976. The *Manufactured Home Construction and Safety Standards* required the installation of smoke alarms in all manufactured housing (formerly called mobile homes). Initially the standard required at least one smoke alarm, powered by the house electrical service, to be installed to protect each sleeping area. Currently, in addition to the smoke alarms to protect each sleeping room, additional smoke alarms must be provided to protect all living and kitchen areas. Alarms located within 20 feet horizontally of cooking equipment must either be equipped with a temporary silencing feature or be of the photoelectric type.

The smoke alarms must be powered by either: a) the house electrical service and a back-up battery (AC-DC), or b) a long life battery.

National Fire Alarm Code

While various codes contain provisions requiring the installation of smoke alarms in various residential occupancies, the most detailed installation, testing and maintenance requirements are contained in NFPA 72 the *National Fire Alarm Code*. This document, or its predecessor NFPA 74, is referenced by all of the codes which require the installation of smoke alarms.

The 1975 edition of NFPA 74 based requirements for the installation of smoke alarms on “levels of protection”. Level 4 protection required a single smoke alarm outside the sleeping rooms and one at the top of a basement stairway. While this document provided a “standard” to be followed, its requirements were largely not based on any fire test data.

In the 1978 edition of the standard, substantial changes were made to reflect the findings of what is known as the “Indiana Dunes” testing. This edition required the installation of a smoke alarm outside each separate sleeping area, in the immediate vicinity of the bedrooms, and on each additional story of the family living unit, including basements, and excluding crawl spaces and unfinished attics. In new construction, the primary power must be supplied by the building electrical service. In existing construction, AC primary power is preferred; however, where such arrangement is not practical, a monitored battery is permitted.

The 2010 edition of NFPA 72 requires that smoke alarms be installed outside each separate sleeping area in the immediate vicinity of the bedrooms, and on each additional story of the family living unit, including basements, and excluding crawl spaces and unfinished attics. In new construction, a smoke alarm is required in each sleeping room. For living units with one or more levels, a smoke alarm is required on the lower level, including basements. In new construction, where more than one smoke alarm is required, the alarms must be arranged so that the operation of any smoke alarm causes the activation of all of the smoke alarms within the dwelling unit.

Smoke alarms in new construction are required to be provided with both a primary AC power supply and a backup battery power supply. The AC power supply must be provided by either a dedicated branch circuit or the un-switched portion of a branch circuit also used for power and lighting. The AC branch circuit may not be protected by a ground-fault circuit-interrupter (GFCI). In existing construction, either an AC primary power source or a monitored battery primary source is permitted.

The provisions of NFPA 72 *National Fire Alarm Code* require, as did prior editions of NFPA 74, that all smoke alarms be installed in accordance with the manufacturer's installation instructions. Additionally, the manufacturer's installation instructions are required by the listing criteria of Underwriters Laboratories, Inc., to reference the provisions of NFPA 72.

The required number of smoke alarms may not provide reliable early warning for any area that is separated by a door from the areas protected by the required alarms. Because of this it is recommended, but not required, that additional alarms be installed in such areas as basements, bedrooms, dining rooms, furnace rooms, utility rooms and hallways not protected by the required smoke alarms.

Where more than one smoke alarm is installed in a dwelling unit NFPA 72 requires that all devices be "interconnected" so that when one alarm senses smoke all "interconnected" devices sound their integral alarms. Such interconnection may be accomplished by either hard-wiring or wireless technology.

The Human Element

Several aspects of human behavior greatly affect the ability of smoke alarms to properly protect occupants when a fire occurs in a dwelling. Failure to test the alarm, regularly replace batteries, removal of the smoke alarm with the intent of repair or replacement, improper installation and general lack of knowledge concerning the value and importance of smoke alarms all lead to the lack of proper effectiveness of these life saving devices..

The National Fire Protection Association (NFPA) reported in September 2011 that ninety-six percent of all homes have at least one smoke alarm, according to a telephone survey. Overall, three-quarters of all U.S. homes have at least one *working* smoke alarm. Almost two-thirds of home fire deaths from 2005 to 2009 resulted from fires in homes with no smoke alarms or no working smoke alarms. When smoke alarms fail to operate, it is usually found to be due to missing, disconnected or dead batteries. Almost one-quarter of smoke alarm failures were due to dead batteries. Awareness education is still lacking, promulgating the “It won’t happen to me” attitude of most Americans.

According to a 2008–2010 topical report from the United States Fire Administration (USFA), seventy-nine percent of injuries resulting from residential fires involved smoke inhalation and thermal burns. Additionally, the leading human factor contributing to injuries in residential fires was being “asleep” (55%), followed by alcohol impairment (18%), unattended or unsupervised persons (11.9%), physically disabled (10%), impaired by other drugs or chemicals (7.2%), mental disability (7%), unconscious (5.7) or physically restrained (0.6%). Forty-nine percent of civilians injured in residential fires were aged 20-49, eighteen percent were less than 20 years of age, and thirty-four percent were aged 50 and over. The statistics bear out the obvious. A nonfunctioning smoke alarm cannot wake you up. If you are unaware of the danger, you have no chance to take the appropriate action needed to save your life.

As our older population continues to expand we will, inevitably, be faced with a growing demographic of those unable to properly hear the alarm, nor, in many cases, will they be able to properly react to the alarm when they hear it. Advancements in sound dynamics have assisted those with hearing loss to better hear the alarm signal. Unfortunately, improved audibility does not adequately address the issue of physical and/or cognitive impairment. A person must be able to self-rescue, removing themselves from the hazardous environment if they are to

survive when fire strikes. The “Aging in Place” and “Villages” phenomenon that is taking place within our senior communities around the Country will present us with even more challenges as we work to reduce the number of fire fatalities occurring each year.

Smoke alarm technology continues to evolve to address many of these issues. A button to silence an alarm serves to reduce the incidence of battery removal. Long life batteries keep alarms working longer without needed regular battery replacement. Wireless alarms allow for easier interoperability of the devices within a home. While these improvements serve to reduce the amount of human intervention needed to maintain properly operating smoke alarms, action must first be taken see that these new technologies are exploited to the extreme

THE SIGNATURE OF FIRE

The proper design of a smoke alarm requires an understanding of fire itself; the by-products it produces or "fire signatures" and their effects on life and property; and how it can be detected. Even before actual ignition takes place, the decomposition of materials by heat produces changes in the surrounding environment. As the decomposition progresses and actual ignition takes place, the changes become more pronounced. Any of the changes in the ambient environment are considered a "fire signature" and represent a condition, which can be monitored by a detection device.

In order for the "fire signature" to be useful it must produce a measurable variation in the "normal" or ambient background, conditions. The change is referred to as the "signal" and the ambient background conditions are known as "noise". If all factors were given equal weight, the preferred fire signature would be one which would generate the greatest signal-to-noise ratio during the earliest period of fire development. A "signature" can consist of aerosols, infrared (IR) and ultraviolet (UV) radiant energy, thermal energy and specific gases. In the typical residential setting, the most appropriate signature is "aerosols".

The combustion process results in the release of substantial quantities of solid and liquid particles into the ambient atmosphere. When the particles are suspended in air they are called aerosols. Smoke is the airborne solid and liquid particulates and gases involved when a material undergoes pyrolysis or combustion. Some of the gases commonly produced are carbon monoxide, carbon dioxide, hydrogen cyanide, halogen acids, formaldehyde, and aldehydes, especially acrolein. As smoke "ages" and cools, the particles increase in size due to what is known as Brownian motion. As the particles collide with one another, they agglomerate or stick together. This process will continue until the overall number of particles has substantially decreased and the size of the remaining particles has greatly increased.

During the agglomeration, the most frequent particle sizes are in the range of 0.1 to 1.0 micrometers. Particles less than 0.1 in size will be dissipated by either evaporation or agglomeration. Particles greater than 1.0 micrometer in size will be lost in the process of sedimentation. As a general rule, smoldering fires tend to produce larger

particles than flaming fires, however the maximum relative particulate size for both types of fire appears to be smaller than 0.3 micrometers.

Particles can also be classified as to their ability to scatter light. Particles, which are less than 0.3 micrometers in size, are usually referred to as “invisible”, since they do not scatter visible light in an efficient manner. When particles reach 0.3 micrometers and larger they are considered “visible”, since such particles do scatter light. However, “visible” can be a very relative term. What is “visible” to a smoke detection device may not be “visible” to the naked human eye. The production of aerosols that are “visible” to a smoke detection device can occur prior to actual ignition. This is why many individuals have experienced activation of their smoke alarm during food preparation even when smoke was not “visible” to the eye. Establishing the quantity of aerosols necessary to activate a smoke alarm is a critical factor to providing sufficient early detection and warning without resulting in unnecessary nuisance alarms. This is a function of “sensitivity”.

SMOKE ALARM OPERATING PRINCIPLES

Detection

There are two “basic” types of operating principles which have traditionally been utilized in the residential smoke alarms - ionization and photoelectric. The ionization type provides a somewhat faster response to high-energy or open flaming fires, due to the fact that these types of fires generally produce smaller aerosols. The photoelectric type responds faster to the aerosols generated by low-energy or smoldering fires, since these types of fire tend to produce larger particles.

Ionization Detection

An ionization smoke detector contains a very small quantity of radioactive material inside a component known as a sensing chamber. Normal, clean ambient air is electrically insulating; however the air inside the sensing chamber is ionized, therefore it becomes conductive. This results in an electrical current being able to pass between two charged electrodes. When smoke particles enter the sensing chamber, they decrease the ability of the ionized air to conduct electrical current between the electrodes. When the current flow has decreased to a predetermined level, an audible alarm signal is generated through other electrical circuits.

An ionization detector operates on Alpha particle properties. The Alpha particles ionize the air, which breaks the air molecules down into positive ions and negative electrons. When ionized air is introduced into an electric field, as it is when placed between the charged electrodes in the sensing chamber, the charges on the ions and the electrons cause them to move, generating a current.

Photoelectric Detection

The suspended aerosols generated during the combustion process affect the ability of light to pass through the air. This effect can be utilized to detect the presence of "smoke" in two ways: 1) obscuration of light intensity over the beam path or 2) scattering of the light beam.

Photoelectric detectors that operate on the light obscuration principle consist of a light source and photosensitive (light) device. Under non-fire conditions, a certain level of light is "seen" by the photosensitive device. When smoke obscures the transmission of the light beam, the amount of light reaching the photosensitive device is reduced, and when the light level drops to a predetermined level, an alarm condition is generated. The amount of light reaching the photosensitive device can be obscured by dense smoke obscuring part of the light beam, or light smoke obscuring more of the beam. Many of the early photoelectric detectors utilized the obscuration principle. Figure 3-4 depicts the use of the obscuration principle.

The light source for many of these early photoelectric devices was an incandescent lamp, which generated two problem areas. One was the relatively short life expectancy of the lamp itself. The other was that the amount of power necessary to operate the lamp limited the device to one, which was powered by the building's electrical service. Today the light source is a light emitting diode or LED, which not only has a reliable long life but also has a substantially lower current requirement. Utilizing a pulsed LED has even further reduced the current requirement.

While the problems associated with the light source have been addressed, most photoelectric detectors used today in the residential setting utilize the light-scattering principle. Light scattering occurs when smoke enters a light path. Detectors using this principle consist of a light source and a photosensitive device, which are arranged so that the light rays cannot normally be seen by the photosensitive device. The device is based on the simple principle that light travels in a straight line. When aerosols enter the light path, the light is scattered "around the corner" so that the photosensitive device can see it. When a predetermined amount of light is seen, an alarm condition is generated. The light source for the photoelectric smoke alarm being marketed today is pulsed LED. This results in the availability of this type of detector in models powered by either the building's electrical service or a battery.

The color of the smoke particle also affects the response characteristics of a photoelectric device. Black smoke, such as that produced by burning plastics or

flammable liquids absorb a portion of the light striking them, resulting in less light being reflected onto the photosensitive device. Therefore it can take up to five times the quantity of black smoke as of gray or white smoke to cause a light scattering photoelectric device to "alarm".

Ionization Versus Photoelectric

A very pertinent question is: which type of smoke alarm (ionization or photoelectric) is most appropriate for the typical residential setting. From August 1973 to August 1974, Richard Bukowski was sponsored by Underwriters' Laboratory as a research associate at the National Bureau of Standards Center for Fire Research for the purpose of developing specifications for residential smoke alarms. At this time, there were no published standards for such smoke alarms. A criteria established early in the program was that all smoke alarms should be tested to the same conditions regardless of the operating principle (ionization versus photoelectric) used. A series of 27 test fires were conducted utilizing differing fuel packages. The fuels used included: shredded newspaper, polystyrene foam, wood crib, gasoline, and raw cotton.

All test fires were conducted in the same test room, which is 60 feet by 60 feet by 15.75 feet high. The test fires were located 3.75 feet above the floor, or approximately 12 feet below the ceiling. The alarms were placed on the ceiling approximately 21 feet from a point directly over the fire center. In addition to the individual alarm devices, two photoelectric beams were used to measure visible smoke obscuration and optical density. To measure temperature, one thermocouple was placed over the fire location, and another was placed at the alarm device location. Carbon monoxide levels were monitored in parts per million, with peak values being recorded during each test.

As a result of these tests, Bukowski wrote, "(i)n those tests where open flaming and little visible smoke predominated, the ionization smoke detectors demonstrated their superiority over photoelectric smoke detectors under these types of fire conditions. In those tests where open flaming and significant quantifies of visible smoke were produced simultaneously, neither detector indicated any significant margin of superiority. In one truly smoldering fire, the photoelectric smoke detectors demonstrated their superiority over ionization smoke detectors for this type of fire. The obvious conclusion is that neither detector does well in all types of fires in terms of response. If one could predict with some measure of certainty the type of fire to be detected, then the appropriate detector could be selected. If this predictability is missing, then either type of detector should be able to satisfy the detection needs. The

choice of which to use in this case should be based on other considerations, such as cost, reliability, aesthetics and the like."

Dual Detection and Third Generation Technology

It is interesting that the user's manuals now regularly provided by manufacturers state that for maximum protection, use both types of alarms on each level of your home.

A new type of detector was reportedly developed at Purdue University in West Layette, Indiana. With the aid of fiber optics, the device can "see" reflections of flames on every wall in the structure from a single location. While such a detector would decrease the number of false alarms from conditions such as cooking smoke and steam, it would not provide early warning of a slow smoldering fire with no visible "flames".

What is at the base of this issue is ASET (available safe egress time) vs. RSET (required safe egress time). ASET is the amount of time an occupant has, once notified of a fire event to safely escape before untenable conditions exist. RSET is the total amount of time necessary for the occupant, once aware of the fire event to escape.

Fire testing conducted by Underwriters Laboratories, Inc. (UL) in 2010 clearly demonstrates the changes in ASET, which have occurred over the years due to changes in the contents of a residential dwelling. A video of this testing can be found at: https://www.ul.com/room_fire/room_fire.html

Given the substantial reduction of fire fatalities and injuries which has occurred since the introduction smoke alarms into the residential occupancy setting and the fact that the majority of devices have been and continue to be ionization based, the effectiveness of the ionization technology is obvious.

Further testing at NIST on these issues has been conducted and was detailed in NIST Technical Note 1455-1 February 2008 "*Performance of Home Smoke Alarms: Analysis of the Response of Several Available Technologies in Residential Fire Settings".*

<u>This report concluded the following:</u>

Smoke alarms of either the ionization type or the photoelectric type consistently provided time for occupants to escape from most residential fires.

a. In many cases, available escape time would be sufficient only if households follow the advice of fire safety educators, including sleeping with doors closed while using interconnected smoke alarms to provide audible alarm in each bedroom, and pre-planning and practicing escape so as to reduce pre-movement and movement times.
b. Smoke alarms may not provide protection for people directly exposed to the initial fire development (so-called “intimate with ignition”).
c. Consistent with prior findings, ionization type alarms provided somewhat better response to flaming fires than photoelectric alarms, and photoelectric alarms provided (often) considerably faster response to smoldering fires than ionization type alarms.
d. Smoke alarms of either type installed on every level generally provided positive escape times for different fire types and locations. Adding smoke alarms in bedrooms increased the escape time provided, especially for smoldering fires. It is important to note that the available safe egress times may overlap with the range of estimates of necessary egress time for the residences studied. Some of this is due to conservative tenability criteria based on incapacitation of the most vulnerable occupants that was used for the current study.
e. Escape times in this study were systematically shorter than those found in a similar study conducted in the 1970’s. This is related to some combination of different criteria for time to untenable conditions, improved understanding of the speed and range of threats to tenability, and faster fire development times for today’s products that provide the main fuel sources for fires, such as upholstered furniture and mattresses. It is important to note that while both the 1975 study and the current study attempted to use a representative sample of available and important furnishings, each study included only a small fraction of those available in the marketplace. Still, this study is consistent with other recent studies of furniture and mattresses even though there may be significant differences in the burning behavior between items of furniture.
f. A mechanically aspirated (system-type) photoelectric smoke detector included in the study consistently responded after the other photoelectric smoke alarms, even for smoldering fires where convective flow rates are low and smoke entry might be an issue. Since only one such alarm was included in the study, more general conclusions cannot be drawn.

g. Residential sprinklers activated well after the smoke alarms and after the heat alarms in all of the scenarios. While these sprinklers have an outstanding record of saving lives and property, the later activation time implies that residential sprinkler installations should always include smoke alarms (as currently required in NFPA 13D and 13R) to provide greater escape times for those capable of escaping.

The United States Fire Administration (USFA) recommends that "every residence and place where people sleep be equipped with: both ionization AND photoelectric smoke or alarms, OR dual sensor smoke alarms, which contain both ionization and photoelectric smoke sensors".

The International Association of Fire Chiefs (IAFC), through its Fire & Life Safety Section (FLSS), recommends that IAFC members include the following information when they educate the public about the use of smoke alarms:

> "There are two main types of technologies used in smoke alarms to detect smoke. Both technologies detect all types of growing fires. Ionization alarms, which sell for about $5 for battery-operated models, respond faster to flaming fires, such as those involving paper or flammable liquids. Photoelectric alarms, which sell for about $20, respond faster to smoldering fires, such as those ignited by cigarettes in upholstered furniture, bedding materials, and mattresses. Dual sensor smoke alarms use both ionization and photoelectric sensors and cost about $30.
>
> "Smoke alarms that use either type of sensing technology have been proven to save lives, prevent injuries, and minimize property damage by detecting and alerting residents to fires early in their development, and that the risk of dying from fires in a home without smoke alarms is twice as high as in homes that have working smoke alarms.
>
> "Since it cannot be predicted what type of fire will start in a home, it is important that both smoldering and flaming fires are detected as quickly as possible. The best protection is to have both types of smoke alarms installed, or install dual sensing technology smoke alarms that incorporate both ionization/photoelectric sensors."

The National Fire Protection Association (NFPA) recommends:

> "An IONIZATION smoke alarm is generally more responsive to flaming fires and a PHOTOELECTRIC smoke alarm is generally more responsive to smoldering fires. For the best protection, both types of alarms or combination ionization and photoelectric alarms (also known as dual sensor alarms) are recommended."

The California State Fire Marshal Smoke Alarm Task Force Final Report Analysis and Recommendations – Understanding, Utilization, and Effectiveness of Smoke Detection Technology including Ionization, Photoelectric and other Technologies, issued in August of 2011 states:

> "The task force concluded that any of the currently available listed smoke alarm technologies provide an acceptable level of protection, regardless of the sensing technology, if they are properly located, installed and maintained. However it is recognized that there are certain instances where the nature of the fire scenario in a home, or incapacitation or condition of the occupants may limit the chance of escaping safely from the fire."

The *Recommendations Report - Ohio Smoke Alarm Advisory Task Force* concluded:

> "There are not statistical differences in the performance of the two existing types of smoke alarms initially discussed, i.e. ionization or photoelectric. Both meet current performance standards"

Several states and localities have been persuaded to enact requirements essentially banning the use of ionization type devices and mandating that only photoelectric devices be permitted. This position has been pursued by a limited number of individuals, including one who has publicly stated that ionization devices are "virtually useless". No recognized fire protection regulatory, professional, or research group or organization supports this position. Such a requirement is not supported by the scientific evidence, stifles the ability to utilize new technologies and long-life batteries and could be considered to be a constraint of trade.

New smoke alarm technologies are being investigation and put into the market place on a regular basis. In response to this, the United States Fire Administration jointly funded "The Third Generation Smoke Alarm Project" with the Consumer Product Safety

Commission (CPSC). The purpose of this project is to improve: nuisance alarm immunity, response time and awakening of sleeping occupants. The ultimate goal is to improve ASET while simultaneously improving device reliability. The work, conducted at Oak Ridge Labs, had three principal components:

- Sensor technology: There have been significant advances in sensor technology in the past 40+ years since the use of ionization and photoelectric sensors was first introduced. Advances in manufacturing and semiconductor technology have resulted in a wide variety of inexpensive sensors being available that might have application in low-cost residential smoke alarms.
- Discrimination analysis: Prior work by many of the 'giants' in the smoke detection field has conclusively shown that multiple sensors provide significant opportunity for improving nuisance alarm rejection. While there are several multiple-sensor devices currently on the market, the algorithms used to discriminate between a nuisance alarm and a real fire signature can be improved. Linear Discriminate Analysis (LDA) is a mathematical technique that has not previously been utilized in fire detection. This technique can be implemented on an inexpensive microprocessor integral to the smoke alarm. Work on the development and evaluation of the potential contribution of LDA is currently underway.
- Sounding: Prior research has demonstrated that changes to the frequency of the sound used in an alarm can improve awakening of individuals at both ends of the normal life span. Providing the low-frequency sound that has been shown to be better has also been shown to require more power and a different device sounding device (prototypes have used speakers).

In March of 2012, the United States Fire Administration released the report *"Home Smoke Alarms – A Technology Roadmap" that details the results of the "Third Generation Residential Smoke Alarm Project".* This report states in the Executive Summary:

> "Most residential smoke alarms are based solely upon the detection of smoke aerosol particles emitting from nearly all fires. Ionization and photoelectric aerosol sensors provide sensitivity to various types of smoke aerosols but also, unfortunately, to other aerosols, including cooking fumes, dust and fog. Other principal combustion products, including heat,

carbon monoxide, and carbon dioxide, largely have been ignored as means for fire detection. The purpose of this report is to provide an overview of technologies that could prove helpful in designing improved home fire alarms. Recognition of fire and nuisance events, reliability, lifetime, power, and alerting issues are considered, as well as accessibility of the technology and cost. Based upon these criteria, comparisons between the technologies are provided, and recommendations are given for next-generation smoke alarms."

Key Findings

 Inexpensive microcontrollers can allow advanced signal processing from single or multiple sensors, to discriminate between fire and nuisance sources, and to provide earlier detection.

 Carbon monoxide sensors can serve a dual role of serving as a sensor for fire detection and acting as a sensor for conventional toxic-gas alerting.

 Temperature sensors can act in concert with other sensors to authenticate flaming fires.

 Photoelectric sensors can be improved by using blue light sources and by using dual-angle scattering.

 Material-based sensors, such as heated-metal-oxide or Taguchi sensors, can be very sensitive to fire effluents, but they suffer from interference of other sources and degradation that cannot be easily checked.

 Physical-based sensors, such as nondispersive infrared (NDIR) sensors, can be designed to detect principal combustion products and to be self-checking, but inexpensive versions are not presently available.

 Linear discriminate analysis, a mathematical technique based upon data from fire studies, can be implemented for optimizing signal processing to distinguish between conditions that warrant alarm and those that do not."

With regard to the improvement of the sounding issues, the report states:

"Another important consideration for residential smoke alarms is the means for alerting occupants. The temporal-three (T-3) pattern, as defined by the ISO standard 8201, "Acoustics - Audible Emergency Evacuation Signal," may become the standardized alarm signal. However, a mixed frequency T-3 alert has been found to be more effective than a high-frequency T-3 signal used in current U.S. smoke alarms. Other studies have shown that voice alarms and a lower pitch T-3 signal were better

than high-pitched sounds. Ian Thomas and Dorothy Bruck have found that a 520-Hz square-wave auditory signal is much more effective than the current 3100-Hz T-3 alarm signal. The widely spaced overtones produced by the square-wave excitation of the voice-coil speakers also appear to be important in the alerting action. Resonant sounders are unlikely to be able to effectively produce such frequencies, so a speaker would be required. A speaker could also provide voice alerting, as well as identification of the nature of the problem and a clear message to evacuate."

EVOLUTION OF THE MARYLAND SMOKE DETECTOR LAW

Single station smoke alarms suitable for installation in the home became available to the American consumer in the early 1970's. These battery operated ionization smoke alarms were compact, relatively affordable and fairly easy to install. Residential single station smoke alarms quickly gained in popularity and voluntary installations were becoming commonplace in Maryland and across the country by the mid 1970's.

Today, the term smoke alarm typically refers to a single or multiple station device designed to sense the presence of smoke, typically battery or AC power operated or both, with a built in internal alarm signal. A smoke detector in today's terminology typically refers to a system connected device designed to sense the presence of smoke which is connected into a fire alarm control panel and is part of a fire alarm system or household fire warning system. This was not always the case. Prior to the mid 1990's both the system type devices and the single station units were commonly referred to as smoke detectors. As such, the term smoke detector used throughout this chapter, based upon the language included in the text of the laws at the time they were written, actually refers to what is today known as a smoke alarm.

Legislation was first introduced in the Maryland General Assembly in 1974 to require the installation of automatic smoke detectors in all new residential occupancies in the Maryland. Several local jurisdictions, including Montgomery County, Maryland, had already enacted similar regulations within their counties to require smoke detectors in new residential occupancies. The initial attempt at a statewide law was not successful. Maryland State Fire Marshal James C. Robertson advised the Maryland State Fire Prevention Commission on April 2, 1974 that the smoke detector legislation, Senate Bill 956 was most likely introduced too late for passage and probably would not be approved that year due to the lateness of the legislative session. Members of the commission requested literature for review on smoke detectors.

House Bill 414, introduced by Delegates Hagner and Rosenshine, was presented to the Maryland House of Delegates in January of 1975. This bill would create a new Section 12A of Article 38A, Fires and Investigations, of the Annotated Code of Maryland, to be

entitled Smoke Detection Systems. Fire Marshal Robertson discussed this bill with the Maryland State Fire Prevention Commission at their meeting on February 11, 1975, including some proposed word changes concerning required approval by the fire department for every individual, firm or corporation commercially selling, installing or repairing fire detection systems.
New Section 12A of Article 38A specified that "Each dwelling unit within a hotel, multi-family, or one and two family building shall be provided with a minimum of one approved smoke detector sensing visible or invisible particles of combustion installed in a manner and location approved by the Fire Prevention Commission. When activated, the detector shall provide an alarm suitable to warn the occupants within the individual dwelling units. Each sleeping area within all occupancies classified residential as defined in Chapter 11 of the National Fire Protection Association Life Safety Code, 1973 edition, shall be provided with a minimum of one approved smoke detector sensing visible or invisible particles of combustion installed in a manner and location approved by the Fire Prevention Commission. When activated, the detector shall provide an alarm suitable to warn the occupants."

The proposed law included an exception for existing hotels and multi-family dwellings with ten units or more, which complied with the provisions of the 1973 edition of NFPA 101, *Life Safety Code*. Existing hotels and multi-family buildings of ten units or more, which did not comply with the Life Safety Code, were allowed three years from the adoption date to comply with the smoke detector requirement.

The law required that smoke detection systems operate on an AC primary source of electric power and that each detector be wired into the circuit serving the area in which it was located. A provision was included in the law to permit the State Fire Prevention Commission to approve power supplies other than an AC primary power source, but only when it was clearly evident that reasonable safety was ensured. The law further required smoke detecting devices to be installed not to exceed the lineal or square footage allowances specified, based on the generally accepted test standards under which they were tested and approved. Approval of the State Fire Marshal will be required by every individual, firm or corporation commercially selling, installing or repairing smoke detection systems. Finally, the State Fire Prevention Commission was given the authority to approve the installation of an automatic sprinkler system in lieu of a required smoke detection system.

Section 12A of Article 38A was approved by the Maryland Legislature with an effective date of July 1, 1975. Fire Marshal Robertson notified the State Fire Prevention Commission at their meeting on May 22, 1975 that the Commission and the State Fire Marshal's Office would soon have the added responsibility to ensure that smoke detectors are installed in all new residences occupied after July 1, 1975 throughout the State and that the requirement would be retroactive to all existing multi-family units and hotels with more than ten units. We believe this to be one of the first statewide smoke detector requirements in the country. An opinion issued by the Attorney Generals office in 1975 concluded that when new sleeping areas were added after July 1, 1975 to existing residential buildings, the sleeping area addition must contain smoke detectors. It appears that the law was to apply only to new one and two family dwellings constructed after July 1, 1975 and would not be applied to existing one or two family dwellings. Minutes indicate that the State Fire Prevention Commission was discussing the merits of AC power versus battery-operated smoke detectors during this period.

The provisions of Section 12A of Article 38A, Annotated Code of Maryland were expanded in the 1981 legislative session. New wording included "Each occupancy classified residential, as defined in Chapter 11 of the National Fire Protection Association Life Safety Code, 1976 edition, shall be provided with a minimum of one battery or AC power operated smoke detector…" The occupants of existing one, two or three family residential dwellings constructed prior to July 1, 1975 would now be required by law to install and maintain AC power or battery operated smoke detectors in all sleeping areas of the dwelling unit by July 1, 1982. The 1981 legislation also included the first requirements for smoke detectors providing light signals suitable for warning the deaf and hearing impaired.

Changes to the law in 1982 and 1983 eliminated the earlier exceptions, which allowed smoke detectors to be omitted from certain existing hotels, and multi-family dwellings, which complied with the Life Safety Code. Multi-family buildings and hotels constructed prior to July 1, 1975, with four to nine units were required to have AC power operated smoke detectors installed in each sleeping area by January 1, 1983. Previously exempted facilities with ten or more units were required to have AC power operated smoke detectors installed in all sleeping areas by January 1, 1984. Landlords were responsible for the required smoke detector installations in residential occupancies with four or more units and refundable deposits could be charged. The occupant was responsible for smoke detector installations in one, two and three family dwellings. The State Fire Marshal shall charge a $25.00 fee for the approval of each make and model smoke detector to be sold in the State.

A modification to the statute in 1987 required that hotels and motels post a sign at the registration desk specifying the availability of smoke detectors for the hearing impaired. At least one such device was required for each 50 units or portion thereof.

Significant changes were made to Section 12A of Article 38A during the 1988 legislative session. House Bill 117 included requirements for the installation of at least one AC power operated smoke detector in residential occupancies containing alternating current (AC) electrical service, on every level, including basements of all new dwelling units, for which a building permit was issued after January 1, 1989. Multiple smoke detectors within a given dwelling unit would now be required to be interconnected in a manner so that activation of any smoke detector causes activation of all other required smoke detectors within the residential dwelling unit. This law was signed May 17, 1988 with an effective date of July 1, 1988.

The following year, in the 1989 legislative session, changes were made to Section 12A of Article 38A to require that smoke detectors in all new residential dwelling units operate both by battery and on an AC power operated primary source of electric power. This new requirement applied to new residential occupancies for which a building permit was issued on or after July 1, 1990.

A hearing was conducted before the Maryland State Fire Prevention Commission on November 4, 1993. The M. Sauer Company Security Unlimited requested approval for the installation of DC (direct current) smoke detection systems in residential occupancies throughout the State rather than the AC power, battery backup smoke detectors specified in the State Law. Section 12A of Article 38A specified that the Fire Prevention Commission did have the authority to approve other power supplies and the argument was presented that the household fire warning system provided monitoring of the circuits to provide notification of a defect in the system, rendering the DC power operated system more preferable. The State Fire Prevention Commission agreed with this conclusion and issued an order on December 16, 1993 allowing M. Sauer Company Security Unlimited to use DC current in connection with the installation of listed smoke detection systems in residences. This ruling by the commission was interpreted so as to allow other companies to use listed household fire warning smoke detection systems as well.

A new Public Safety Article was created in the Annotated Code of Maryland during the 2004 legislative session. The provisions of Article 38A, Fires and Investigations, were relocated to the new Public Safety Article without substantive change to the existing

wording. Section 12A of Article 38A became Public Safety Article, Title 9, Fire Protection and Prevention, Subtitle 1, Smoke Detection Systems, with the requirements for smoke alarms in both new and existing residential occupancies remaining essentially unchanged.

Public Safety Article, Title 12, Subtitle 11, Carbon Monoxide Alarms was passed by the 2007 general assembly to require AC power, battery backup carbon monoxide alarms in all new dwellings, including multifamily, hotels and dormitories constructed after January 1, 2008 where the dwelling relies on the combustion of fossil fuel for heat, ventilation, hot water or clothes dryer operation. Carbon monoxide alarms are required to be located in a central location outside of each sleeping area and combination smoke alarm carbon monoxide alarm units may be used.

The 2010 legislative session included the passage of a bill to eliminate the requirement that the Maryland State Fire Marshal approve every make and model of smoke alarm sold within the State. This law was antiquated and served no real purpose with respect to public safety. Any smoke alarm tested and listed by an approved independent testing laboratory may now legally be sold in Maryland without the need to have the unit approved for sale in Maryland.

THE EXISTING MARYLAND SMOKE DETECTOR LAW

PUBLIC SAFETY TITLE 9

SUBTITLE 1. SMOKE DETECTION SYSTEMS

9-101. Scope of subtitle.

(a) *Applicability in Baltimore City.*-

(1) Notwithstanding any other provision of this article, this subtitle applies in Baltimore City.

(2) In Baltimore City, the Baltimore City fire department shall enforce this subtitle.

(3) In Baltimore City, appeals concerning this subtitle shall be made to the Baltimore City fire board.

(b) *Effect of subtitle.*- This subtitle does not affect a public local law or regulation that existed on July 1, 1982, that required smoke detectors in occupancies with less than ten dwelling units.

9-102. Installation of smoke detectors required.

(a) *In general.*-

(1) Each sleeping area within each occupancy classified residential, as defined in the most recent edition of the National Fire Protection Association Life Safety Code adopted by the State Fire Prevention Commission, shall be equipped with at least one approved smoke detector that:

(i) senses visible or invisible particles of combustion; and

(ii) is installed in a manner and location approved by the State Fire Prevention Commission.

(2) When activated, the smoke detector shall provide an alarm suitable to warn the occupants.

(b) *Landlords and tenants.*-

(1) The landlord shall install smoke detectors as required under subsection (a) of this section.

(2) On written notification by certified mail by the tenant or on notification in person by the tenant, the landlord shall repair or replace the smoke detector.

(3) If the tenant personally notifies the landlord of the failure of a smoke detector, the landlord shall provide a written receipt acknowledging the notification.

(4) A tenant may not remove a smoke detector or render a smoke detector inoperative.

(5) Except for hotels or motels, a landlord may require a refundable deposit for a smoke detector not exceeding the value of the smoke detector.

(6) On written request of a tenant who is deaf or hearing impaired, the landlord shall provide a smoke detector that, when activated, provides a signal that:

(i) is approved by a nationally recognized testing laboratory for electrical appliances; and

(ii) is sufficient to warn the deaf or hearing impaired tenant.

(c) *Hotels and motels.*-

(1) Regardless of the number of units, each hotel or motel shall have available at least one smoke detector for the deaf or hearing impaired for each 50 units or fraction of 50 units.

(2) The hotel or motel may require a refundable deposit for a portable smoke detector not exceeding the value of the smoke detector.

(3) The hotel or motel shall post in a conspicuous place at the registration desk a permanent sign that states the availability of smoke detectors for the deaf or hearing impaired.

(d) *Residential dwellings.*- On or before July 1, 1982, an occupant of a one, two, or three family residential dwelling constructed before July 1, 1975, shall:

(1) equip each occupant's living unit with at least one approved battery or alternating current (AC) primary electric powered smoke detector; and

(2) maintain the smoke detector.

9-103. Construction of new residential dwelling units.

(a) *Minimum number of smoke detectors.*- At least one smoke detector shall be installed on each level, including a basement but excluding an attic, of each new residential dwelling unit:

(1) that contains alternating current (AC) electrical service;

(2) that is classified residential, as defined in the most recent edition of the National Fire Protection Association Life Safety Code adopted by the State Fire Prevention Commission; and

(3) for which a building permit is issued for new construction on or after January 1, 1989.

(b) *Activation of multiple smoke detectors.*- If two or more smoke detectors are required under subsection (a) of this section, the smoke detectors shall be of a type and installed in a manner so that activation of one smoke detector causes activation of all other required smoke detectors in the residential dwelling unit.

(c) *Operation by battery and electric power.*- A smoke detector required under this subtitle shall operate both by battery and on an alternating current (AC) primary source of electric power if the smoke detector is installed in a new residential dwelling unit:

(1) that contains alternating current (AC) electrical service;

(2) that is designed to be occupied by one or more families; and

(3) for which a building permit is issued for new construction on or after July 1, 1990.

(d) *Enforcement of section; enactment of more stringent laws.*- This section:

(1) may be enforced by a county fire chief, fire administrator, or municipal fire chief; and

(2) does not prevent a county from enacting more stringent laws that relate to smoke detectors.

9-104. General requirements for smoke detectors.

(a) *Alternating current primary source of electric power; exceptions.*-

(1) Except as provided in paragraph (2) of this subsection and 9-102(d) of this subtitle, smoke detection systems shall operate on an alternating current (AC) primary source of electric power.

(2) Smoke detection systems may operate on approved power supplies other than an alternating current (AC) primary source of electric power if:

(i) the power supply is approved by the State Fire Prevention Commission; and

(ii) it is clearly evident that reasonable safety is secured.

(b) *Lineal or square footage allowances.*- Each approved smoke detector shall be installed so as not to exceed the lineal or square footage allowances specified for the smoke detector, based on the generally accepted test standards under which the smoke detector was tested and approved.

(c) *Approval and use.*- Smoke detection systems, including specialized smoke detectors for the deaf and hearing impaired, shall be approved for the particular system and shall only be used for detection and signaling in the event of fire.

(d) *Leases for residential dwelling units.*- Each lease for an existing residential dwelling unit that contains alternating current (AC) electric service shall contain a disclosure in 10-point bold type that states:

"This residential dwelling unit contains alternating current (AC) electric service. In the event of a power outage, an alternating current (AC) powered smoke detector will not provide an alarm. Therefore, the occupant should obtain a dual powered smoke detector or a battery powered smoke detector."

9-106. Sprinkler systems.

(a) *In general.*- If approved by the State Fire Prevention Commission, an approved automatic fire sprinkler system may be installed instead of a smoke detection system.

(b) *Effect on other requirements.*- Installing an approved automatic fire sprinkler system does not nullify the other requirements of the State Fire Prevention Code or exempt an occupancy from other requirements that are clearly applicable under the State Fire Prevention Code.

9-107. Property insurance claims.

Failure to comply with this subtitle may not be used as a policy defense in the settlement of a property insurance claim.

9-108. Smoke detection installation order.

(a) *In general.*- If after investigating a fire in a one, two, or three family residential dwelling the State Fire Marshal or local investigating authority finds the absence of required smoke detectors, the State Fire Marshal or local investigating authority shall issue to the occupant a smoke detection installation order.

(b) *Failure to comply with order.*- A person may not fail to comply with a smoke detection installation order within 15 days of reoccupancy.

(c) *Penalty.*-

(1) A person who violates subsection (b) of this section is guilty of a misdemeanor and on conviction is subject to a fine not exceeding $50.

(2) The penalty provision of 9-109 of this subtitle does not apply to this section.

9-109. Violation of subtitle.

(a) *Prohibited.*- A person may not knowingly violate this subtitle.

(b) *Penalty.*- A person who violates this section is guilty of a misdemeanor and on conviction is subject to imprisonment not exceeding 10 days or a fine not exceeding $1,000 or both.

CONCLUSIONS OF THE TASK FORCE

1. Since the 1973 America Burning Report, annual fire deaths in America have been significantly reduced from the range of 6,500 deaths per year to 3,120 deaths in 2010. A similar trend is evident in Maryland where fire deaths have dropped from 206 deaths in 1966 to 184 deaths in 1975 to 67 deaths in 2011. Residential smoke alarms, both ionization and photoelectric, have played a significant role in the reduction in the national and statewide fire deaths. *(ref. 1)*

2. An NFPA Fire Analysis and Research Division report specifies that nearly two-thirds of residential fire deaths occur in homes with no working smoke alarms; with no smoke alarm present in the home in about 38% of the cases and with smoke alarms present which failed to operate in about 24% of the incidents. Missing or dead batteries are the predominant reason for smoke alarms failing to activate in a residential fire. Any action taken by the Maryland Smoke Alarm Task Force to reduce residential fire deaths in Maryland through smoke alarm technology will need to include specific measures to substantially reduce the potential that smoke alarms will be removed or fail to operate due to dead or missing batteries. The use of sealed battery operated units with long life batteries and hush button silence features has the potential to dramatically reduce the number of instances of smoke alarm failures. *(ref. 2)*

3. The present Maryland smoke alarm law requires a smoke alarm in each residential sleeping area. Historically, this has resulted in the installation of a smoke alarm in the hallway outside bedrooms. The smoke alarm may be battery operated for existing dwellings constructed prior to 1975. An older two-story home with a basement level may presently comply with the existing law with a single battery operated smoke alarm with a removable battery located on the second floor hallway outside of the bedrooms. This level of coverage is not adequate. Significant fire growth can be expected before products of combustion from a fire in a remote part of the dwelling unit reaches the upstairs hallway smoke alarm, limiting the available time for escape. Occupants sleeping in living rooms, recreation rooms or other remote parts of the home may not be alerted by an activated smoke alarm in the second floor hallway.

4. At least one smoke alarm is needed on every level of existing homes. The proposed new smoke alarm law will require additional smoke alarms on every level and within each sleeping room of existing dwellings when any one of a number of conditions occur, or by January 1, 2016 at the latest. Sealed smoke alarms with long life batteries and silence buttons will be required where battery operated smoke alarms are permitted.

5. Both ionization and photoelectric smoke alarms are readily available for early warning detection in residential occupancies. Ionization type smoke alarms clearly activate sooner for rapid growth free burning fires and are slower to activate for smoldering fires, which generate large quantities of smoke. Photoelectric type smoke alarms clearly activate much sooner for the slow growth smoldering fires which generate high quantities of smoke and are much slower to detect the products of combustion from rapid growth free burning fires. Ionization smoke alarms appear to be somewhat more susceptible to nuisance activation alarms due to kitchen cooking functions in the home.

6. Both photoelectric smoke alarms and ionization smoke alarms are listed to comply with UL 217, which includes testing of the smoke alarms for a variety of different fire scenarios. Both have proven effective in providing early warning notification to residential occupants when a fire occurs in the dwelling unit. The consensus of the task force is that there is no compelling basis to change the Maryland Smoke Alarm Law to mandate the use of only one type of smoke alarm.

7. Smoke alarms located in the vicinity of kitchen cooking operations are a leading cause of nuisance smoke alarm activations. Criteria now included in NFPA 72 to require that ionization smoke alarms be located away from cooking equipment is applicable and judged to be reasonable to reduce the number of nuisance smoke alarm activations. (ref 3)

8. New and evolving smoke alarm technologies appear to be promising, including those using various combinations of photoelectric, ionization, and carbon monoxide sensing chambers, smoke alarms using microprocessor based technology(ref 4,5) and even appliance based fire detection that signals the

homes smoke alarms should they sense an event(ref 6). These technologies are being used to improve smoke alarm activation times and at the same time reduce nuisance alarms which will increase the probability that smoke alarms will be present and operational in residential occupancies when a fire occurs. The Task Force recommends and encourages the use of this technology for the installation or replacement of smoke alarms in residential occupancies.

9. The most desirable level of smoke alarm coverage in existing older homes is interconnected AC-power operated, battery back-up smoke alarms on every level and within every bedroom of the home. This level of coverage would require extensive electrical wiring on multiple levels of the home, both to power the smoke alarms and to interconnect the units. It appears unlikely that a major change in the smoke alarm law to mandate this level of coverage in every existing home in Maryland would be approved through the legislative process.

10. The existing Maryland Smoke Alarm Law has been modified on multiple occasions through the years resulting in a law, which is difficult to follow and interpret. The law needs to be revised in order that applicable requirements are grouped in a logical manner, which is relatively easy to understand, comply with, and enforce.

11. Despite the existing thirty-seven year old smoke alarm law and the repeated efforts of the fire protection community over the years to encourage the widespread use of smoke alarms, it is clear that too many older homes in Maryland still lack functioning early warning smoke detection. One and two-family dwellings units are exempt from the State Fire Prevention Code and fire authorities have no legal right of entry into individual occupied dwellings to verify that smoke alarms are present and operational.

12. Widespread publicity associated with the proposed updated smoke alarm law will be needed to significantly increase the number of dwelling units with operational smoke alarms. The use of modern social media and traditional media outlets will be needed to reach the greatest segment of our citizens. Innovative approaches and smoke alarm give-away and installation programs will be needed to reach those who most likely do not have operating smoke alarms within their homes.

13. Properly installed and functioning smoke alarms may not be capable of providing adequate warning to the very young, the very old and occupants whose abilities are impaired due to the use of drugs or alcohol. Even when alerted, these occupants may not have the capability to take prompt and appropriate action for self-preservation. Continued research is encouraged to improve smoke alarm notification technology and educational campaigns should target those individuals with special needs.

14. Properly installed interconnected smoke alarms combined with residential automatic sprinkler protection clearly provide the greatest potential for surviving any residential fire. Both will be needed to impact and significantly reduce the present numbers of fire deaths in Maryland.

15. Fire department smoke alarm give-away/installation programs have been very effective in many areas of the State in getting smoke alarms into many older homes which otherwise would not have them. Historically, these programs have been conducted using the least expensive battery operated smoke alarms on the market. The probability that the battery will simply be removed by the occupant due to nuisance alarms or due to end of battery life signals is simply too high. Fire department smoke alarm programs across the State need to switch to sealed units with long life batteries. Through bulk purchasing and alternative funding sources this will be accomplished in a cost effective manner.

16. Members of the smoke alarm task force reported difficulty discerning between the test button and the silence button on some model smoke alarms. Fire service personnel in the field face the same difficulty. It is completely unrealistic to expect the general public to be able to distinguish between the two buttons unless they are clearly identified using large contrasting lettering on the face of the smoke alarm. A single properly identified button to perform both functions is a recommended alternative.

17. Smoke alarm packaging information needs to improve to properly identify the type of smoke alarm, the power source, the date of manufacture and the required replacement date of the device on the front face of the package.

References:

1: America Burning – National Commission on Fire Prevention and Control – Washington, DC – 1973

#2: Aherns, M. - Smoke Alarms in U.S. Home Fires – National Fire Protection Association – September 2011

#3 NFPA 72 – National Fire Alarm & Signaling Code 2010 edition – National Fire Protection Association – Quincy, MA

#4: Technologies for Residential Fire Detection; A Roadmap to a Third Generation Residential Fire Alarm – USFA- CPSC

#5*: IOPHIC: Universal Sensing Technology, An Introduction* Universal Security Instruments

#6: *Flame Detection and Wireless Communications in a Consumer Appliance to Improve Fire Detection Capabilities* Naval Research Laboratory

RECOMMENDATIONS

PROPOSED LEGISLATIVE CHANGES

PROPOSED NEW MARYLAND SMOKE ALARM LAW
PUBLIC SAFETY ARTICLE
TITLE 9, FIRE PROTECTION AND PREVENTION
SUBTITLE 1, RESIDENTIAL SMOKE ALARMS

****PLEASE NOTE AS YOU READ THE FOLLOWING****

CAPITALS INDICATE MATTER ADDED TO EXISTING LAW
[Brackets] indicate matter deleted from existing law
Underlining indicates amendments to bill
~~Strike out~~ indicates matter stricken from bill by amendment or deleted from the law by amendment.

AN ACT concerning

Public Safety - Fire Protection and Prevention – Residential Smoke Alarms

FOR the purpose of updating the present thirty-seven year old Maryland Smoke Alarm Law to eliminate antiquated and confusing language and to more closely correspond with present day fire code and building code smoke alarm requirements; providing for the use of new and evolving smoke alarm technology; and providing for improved smoke alarm coverage in many older homes.

BY repealing and reenacting with amendments
Article – Public Safety
Section 9-101 through 9-108
Annotated Code of Maryland
(2012 Replacement Volume)

PUBLIC SAFETY

TITLE9. FIRE PROTECTION AND PREVENTION

SUBTITLE 1. [SMOKE DETECTION SYSTEMS] RESIDENTIAL SMOKE ALARMS

§ 9-101. [Scope of subtitle] INSTALLATION OF SMOKE ALARMS REQUIRED

[(a) Applicability in Baltimore City.

(1) Notwithstanding any other provision of this article, this subtitle applies in Baltimore City.

(2) In Baltimore City, the Baltimore City fire department shall enforce this subtitle.

(3) In Baltimore City, appeals concerning this subtitle shall be made to the Baltimore City fire board.]

(a) AN APPROVED AUTOMATIC SMOKE ALARM SHALL BE PROVIDED IN EACH SLEEPING AREA WITHIN EVERY RESIDENTIAL OCCUPANCY INCLUDING ONE AND TWO-FAMILY DWELLINGS, LODGING OR ROOMING HOUSES, HOTELS, DORMITORIES, AND APARTMENT BUILDINGS AS DEFINED IN NFPA 101, LIFE SAFETY CODE AS ADOPTED BY THE STATE FIRE PREVENTION COMMISSION.

[(b) Effect of subtitle. -- This subtitle does not affect a public local law or regulation that existed on July 1, 1982, that required smoke detectors in occupancies with less than ten dwelling units.]

(b) SMOKE ALARMS SHALL BE INSTALLED IN ACCORDANCE WITH NFPA 72, NATIONAL FIRE ALARM CODE AS REFERENCED BY THE STATE FIRE PREVENTION CODE.

(c) SMOKE ALARMS SHALL BE LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY APPROVED BY THE STATE FIRE MARSHAL TO COMPLY WITH UNDERWRITERS LABORATORIES UL 217, “STANDARD FOR SAFETY FOR SINGLE AND MULTIPLE STATION SMOKE ALARMS”.

(d) SMOKE ALARMS SHALL BE SUITABLE FOR SENSING VISIBLE OR INVISIBLE PRODUCTS OF COMBUSTION AND SHALL SOUND AN ALARM SUITABLE TO WARN THE OCCUPANTS.

(e) NOTWITHSTANDING ANY OTHER PROVISION OF THIS ARTICLE, THIS SUBTITLE SHALL APPLY THROUGHOUT MARYLAND, INCLUDING THE CITY OF BALTIMORE.

(f) LOCAL JURISDICTIONS MAY ADOPT SMOKE ALARM REGULATIONS WHICH ARE MORE STRINGENT THAN THE PROVISIONS OF THIS SUBTITLE.

§ 9-102. [Installation of smoke detectors required] SMOKE ALARMS IN RESIDENTIAL OCCUPANCIES CONSTRUCTED AFTER JULY 1, 2013

[(a) In general.

(1) Each sleeping area within each occupancy classified residential, as defined in the most recent edition of the National Fire Protection Association Life Safety Code adopted by the State Fire Prevention Commission, shall be equipped with at least one approved smoke detector that:

(i) senses visible or invisible particles of combustion; and

(ii) is installed in a manner and location approved by the State Fire Prevention Commission.

(2) When activated, the smoke detector shall provide an alarm suitable to warn the occupants.]

(a) MINIMUM NUMBER OF SMOKE ALARMS - AT LEAST ONE APPROVED SMOKE ALARM SHALL BE INSTALLED WITHIN EVERY SLEEPING ROOM; IN THE HALLWAY OR COMMON AREA OUTSIDE OF SLEEPING ROOMS; AND IN THE HALLWAY OR COMMON AREA ON EVERY LEVEL OF A RESIDENTIAL OCCUPANCY, INCLUDING BASEMENTS AND EXCLUDING UNOCCUPIED ATTICS, GARAGES AND CRAWL SPACES.

[(b) Landlords and tenants.

(1) The landlord shall install smoke detectors as required under subsection (a) of this section.

(2) On written notification by certified mail by the tenant or on notification in person by the tenant, the landlord shall repair or replace the smoke detector.

(3) If the tenant personally notifies the landlord of the failure of a smoke detector, the landlord shall provide a written receipt acknowledging the notification.

(4) A tenant may not remove a smoke detector or render a smoke detector inoperative.

(5) Except for hotels or motels, a landlord may require a refundable deposit for a smoke detector not exceeding the value of the smoke detector.

(6) On written request of a tenant who is deaf or hearing impaired, the landlord shall provide a smoke detector that, when activated, provides a signal that:

(i) is approved by a nationally recognized testing laboratory for electrical appliances; and

(ii) is sufficient to warn the deaf or hearing impaired tenant.]

(b) MULTIPLE SMOKE ALARMS – WHERE TWO OR MORE SMOKE ALARMS ARE REQUIRED WITHIN A RESIDENTIAL UNIT, THE SMOKE ALARMS SHALL BE ARRANGED SO THAT ACTIVATION OF ANY ONE SMOKE ALARM CAUSES ALARM ACTIVATION OF ALL OTHER REQUIRED SMOKE ALARMS WITHIN THE RESIDENTIAL UNIT.

[(c) Hotels and motels.

(1) Regardless of the number of units, each hotel or motel shall have available at least one smoke detector for the deaf or hearing impaired for each 50 units or fraction of 50 units.

(2) The hotel or motel may require a refundable deposit for a portable smoke detector not exceeding the value of the smoke detector.

(3) The hotel or motel shall post in a conspicuous place at the registration desk a permanent sign that states the availability of smoke detectors for the deaf or hearing impaired.]

(c) OPERATION BY ELECTRIC POWER AND A SECONDARY POWER SOURCE – SMOKE ALARMS REQUIRED IN THIS SECTION SHALL OPERATE ON AN ALTERNATING CURRENT (AC) PRIMARY SOURCE OF ELECTRIC POWER WITH BATTERY BACKUP OR AN APPROVED ALTERNATE SECONDARY POWER SOURCE.

[(d) Residential dwellings. -- On or before July 1, 1982, an occupant of a one, two, or three family residential dwelling constructed before July 1, 1975, shall:

(1) equip each occupant's living unit with at least one approved battery or alternating current (AC) primary electric powered smoke detector; and

(2) maintain the smoke detector.]

(d) HOUSEHOLD FIRE ALARM SYSTEMS – IN ONE AND TWO-FAMILY DWELLINGS, SMOKE DETECTORS INSTALLED AS A PART OF AN APPROVED HOUSEHOLD FIRE ALARM SYSTEM SHALL BE AN ACCEPTABLE ALTERNATIVE TO THE AC POWERED – BATTERY BACKUP SMOKE ALARMS REQUIRED IN THIS

SECTION, PROVIDED THE SMOKE DETECTORS ARE INSTALLED AND LOCATED AS SPECIFIED IN SECTION (a) ABOVE.

(e) FIRE ALARM SYSTEMS – SMOKE DETECTORS INSTALLED AS A PART OF AN APPROVED FIRE ALARM SYSTEM ARE AN ACCEPTABLE ALTERNATIVE TO THE AC POWERED – BATTERY BACKUP SMOKE ALARMS REQUIRED IN THIS SECTION, PROVIDED THE SMOKE DETECTORS ARE INSTALLED AND LOCATED AS SPECIFIED IN SECTION (a) ABOVE.

§ 9-103. [Construction of new residential dwelling units] SMOKE ALARMS IN EXISTING RESIDENTIAL OCCUPANCIES

(a) [Minimum number of smoke detectors. -- At least one smoke detector shall be installed on each level, including a basement but excluding an attic, of each new residential dwelling unit:] MINIMUM NUMBER OF SMOKE ALARMS – AT LEAST ONE APPROVED SMOKE ALARM SHALL BE PROVIDED IN EACH RESIDENTIAL SLEEPING AREA:

(b)

(1) [that contains alternating current (AC) electrical service;] SMOKE ALARMS REQUIRED IN ONE AND TWO-FAMILY DWELLINGS CONSTRUCTED PRIOR TO JULY 1, 1975 SHALL BE BATTERY POWERED OR AC PRIMARY ELECTRIC POWERED UNITS.

(2)[that is classified residential, as defined in the most recent edition of the National Fire Protection Association Life Safety Code adopted by the State Fire Prevention Commission; and] SMOKE ALARMS REQUIRED IN ONE AND TWO-FAMILY DWELLINGS CONSTRUCTED BETWEEN JULY 1, 1975 AND JUNE 30, 1990 SHALL BE AC PRIMARY ELECTRIC POWERED UNITS.

(3) [for which a building permit is issued for new construction on or after January 1, 1989.] SMOKE ALARMS REQUIRED IN MULTIFAMILY RESIDENTIAL OCCUPANCIES INCLUDING APARTMENTS, LODGING OR ROOMING HOUSES, DORMITORIES, AND HOTELS SHALL BE AC PRIMARY ELECTRIC POWERED UNITS.

(4) SMOKE ALARMS REQUIRED IN A RESIDENTIAL OCCUPANCY CONSTRUCTED AFTER JULY 1, 1990 SHALL OPERATE ON AN ALTERNATING CURRENT (AC) PRIMARY SOURCE OF ELECTRIC POWER WITH BATTERY BACKUP OR AN APPROVED ALTERNATE SECONDARY POWER SOURCE.

(b) [Activation of multiple smoke detectors. -- If two or more smoke detectors are required under subsection (a) of this section, the smoke detectors shall be of a type and installed in a manner so that activation of one smoke detector causes activation of all other required smoke detectors in the residential dwelling unit.] MULTIPLE SMOKE ALARMS – EACH LEVEL – AT LEAST ONE APPROVED SMOKE ALARM SHALL BE INSTALLED ON EVERY LEVEL OF A RESIDENTIAL OCCUPANCY CONSTRUCTED AFTER JANUARY 1, 1989, INCLUDING BASEMENTS AND EXCLUDING UNOCCUPIED ATTICS, GARAGES AND CRAWL SPACES.

[(c) Operation by battery and electric power. -- A smoke detector required under this subtitle shall operate both by battery and on an alternating current (AC) primary source of electric power if the smoke detector is installed in a new residential dwelling unit:

(1) that contains alternating current (AC) electrical service;

(2) that is designed to be occupied by one or more families; and

(3) for which a building permit is issued for new construction on or after July 1, 1990.]

(c) MULTIPLE SMOKE ALARMS – WHERE TWO OR MORE SMOKE ALARMS ARE REQUIRED WITHIN A RESIDENTIAL UNIT CONSTRUCTED AFTER JANUARY 1, 1989, THE SMOKE ALARMS SHALL BE ARRANGED SO THAT ACTIVATION OF ANY ONE SMOKE ALARM CAUSES ALARM ACTIVATION OF ALL OTHER REQUIRED SMOKE ALARMS WITHIN THE RESIDENTIAL UNIT.

[(d) Enforcement of section; enactment of more stringent laws. -- This section:

(1) may be enforced by a county fire chief, fire administrator, or municipal fire chief; and

(2) does not prevent a county from enacting more stringent laws that relate to smoke detectors.]

(d) SMOKE ALARM COVERAGE UPGRADE

(1) SMOKE ALARM COVERAGE SHALL COMPLY WITH 9-103(d)(2) IN EXISTING RESIDENTIAL OCCUPANCIES WHERE A MINIMUM LEVEL OF COVERAGE DOES NOT EXIST, WHEN ANY ONE OF THE FOLLOWING FIRST OCCURS:

(I) THE EXISTING REQUIRED SMOKE ALARM EXCEEDS TEN YEARS FROM THE DATE OF MANUFACTURE

(II) THE REQUIRED SMOKE ALARM FAILS TO RESPOND TO OPERABILITY TESTS OR OTHERWISE MALFUNCTIONS

(III) THERE IS A CHANGE OF OWNERSHIP OR CHANGE OF TENANT IN THE RESIDENTIAL UNIT

(IV) A BUILDING PERMIT IS ISSUED FOR ANY ADDITION OR ALTERATION TO THE RESIDENTIAL UNIT.

(V) JANUARY 1, 2016

(2) UPGRADED SMOKE ALARM COVERAGE SHALL INCLUDE THE FOLLOWING:

(I) A MINIMUM OF ONE APPROVED SMOKE ALARM ON EVERY LEVEL OF THE RESIDENTIAL UNIT, INCLUDING BASEMENTS AND EXCLUDING UNOCCUPIED ATTICS, GARAGES AND CRAWL SPACES.

(II) AN APPROVED SMOKE ALARM WITHIN EACH SLEEPING ROOM

(III) SMOKE ALARMS SHALL BE AC POWER BATTERY BACKUP UNITS, EXCEPT AS FOLLOWS:

(A) SMOKE ALARMS IN ONE AND TWO FAMILY DWELLINGS CONSTRUCTED PRIOR TO JULY 1, 1975 MAY BE BATTERY OPERATED.

(B) SMOKE ALARMS REQUIRED IN NEW LOCATIONS BY THIS SECTION, WHERE SMOKE ALARMS DID NOT PREVIOUSLY EXIST, MAY BE BATTERY OPERATED.

(IV) WHERE BATTERY OPERATED SMOKE ALARMS ARE PERMITTED; SEALED, TAMPER RESISTANT UNITS INCORPORATING A SILENCE/HUSH BUTTON AND USING LONG LIFE BATTERIES SHALL BE USED.

(e) HOUSEHOLD FIRE ALARM SYSTEMS – IN ONE AND TWO-FAMILY DWELLINGS, SMOKE DETECTORS INSTALLED AS A PART OF AN APPROVED HOUSEHOLD FIRE ALARM SYSTEM SHALL BE AN ACCEPTABLE ALTERNATIVE TO THE AC POWERED – BATTERY BACKUP SMOKE ALARMS REQUIRED IN THIS SECTION, PROVIDED THE SMOKE DETECTORS ARE INSTALLED AND LOCATED AS SPECIFIED IN SECTION (a) ABOVE.

(f) FIRE ALARM SYSTEMS – SMOKE DETECTORS INSTALLED AS A PART OF AN APPROVED FIRE ALARM SYSTEM ARE AN ACCEPTABLE ALTERNATIVE TO THE AC POWERED – BATTERY BACKUP SMOKE ALARMS REQUIRED IN THIS SECTION, PROVIDED THE SMOKE DETECTORS ARE INSTALLED AND LOCATED AS SPECIFIED IN SECTION (a) ABOVE.

§ 9-104. [General requirements for smoke detectors] SMOKE ALARMS FOR THE DEAF OR HARD OF HEARING

EVERY SLEEPING ROOM OCCUPIED BY A DEAF OR HARD OF HEARING INDIVIDUAL SHALL BE PROVIDED WITH A SMOKE ALARM SUITABLE TO ALERT THE DEAF OR HARD OF HEARING.

[(a) Alternating current primary source of electric power; exceptions. --

(1) Except as provided in paragraph (2) of this subsection and § 9-102(d) of this subtitle, smoke detection systems shall operate on an alternating current (AC) primary source of electric power.

(2) Smoke detection systems may operate on approved power supplies other than an alternating current (AC) primary source of electric power if:

(i) the power supply is approved by the State Fire Prevention Commission; and

(ii) it is clearly evident that reasonable safety is secured.]

(a) UPON WRITTEN REQUEST ON BEHALF OF A TENANT WHO IS DEAF OR HARD OF HEARING, SLEEPING ROOMS OCCUPIED BY DEAF OR HARD OF HEARING

INDIVIDUALS SHALL BE PROVIDED WITH APPROVED NOTIFICATION APPLIANCES DESIGNED TO ALERT DEAF OR HARD OF HEARING INDIVIDUALS. THE LANDLORD SHALL PROVIDE A NOTIFICATION APPLIANCE THAT, WHEN ACTIVATED, PROVIDES A SIGNAL THAT IS SUFFICIENT TO WARN THE DEAF OR HARD OF HEARING TENANT IN THOSE SLEEPING ROOMS.

[(b) Lineal or square footage allowances. -- Each approved smoke detector shall be installed so as not to exceed the lineal or square footage allowances specified for the smoke detector, based on the generally accepted test standards under which the smoke detector was tested and approved.]

(b) HOTELS AND MOTELS SHALL HAVE AVAILABLE AT LEAST ONE APPROVED NOTIFICATION APPLIANCE FOR THE DEAF OR HARD OF HEARING FOR EACH 50 UNITS OR FRACTION THEREOF.

[(c) Approval and use. -- Smoke detection systems, including specialized smoke detectors for the deaf and hearing impaired, shall be approved for the particular system and shall only be used for detection and signaling in the event of fire.]

(c) HOTELS AND MOTELS SHALL POST IN A CONSPICUOUS PLACE AT THE REGISTRATION DESK A PERMANENT SIGN THAT STATES THE AVAILABILITY OF SMOKE ALARM NOTIFICATION APPLIANCES FOR THE DEAF OR HARD OF HEARING.

[(d) Leases for residential dwelling units. -- Each lease for an existing residential dwelling unit that contains alternating current (AC) electric service shall contain a disclosure in 10-point bold type that states:

"This residential dwelling unit contains alternating current (AC) electric service. In the event of a power outage, an alternating current (AC) powered smoke detector will not provide an alarm. Therefore, the occupant should obtain a dual powered smoke detector or a battery powered smoke detector."]

(d) HOTELS, MOTELS AND LANDLORDS MAY REQUIRE A REFUNDABLE DEPOSIT FOR NOTIFICATION APPLIANCES FOR THE DEAF OR HARD OF HEARING. THE AMOUNT OF THE DEPOSIT SHALL NOT EXCEED THE VALUE OF THE NOTIFICATION APPLIANCE.

§ 9-105. [Sale and installation of smoke detectors or smoke alarms.] GENERAL REQUIREMENTS FOR SMOKE ALARMS

[A person may sell or install a smoke detection system, smoke detector, smoke alarm, or specialized smoke detectors or smoke alarms for the deaf and hard of hearing only in accordance with the State Fire Prevention Code.]

9-105 GENERAL REQUIREMENTS FOR SMOKE ALARMS

(a) ENFORCEMENT – SMOKE ALARM REQUIREMENTS SHALL BE ENFORCED BY THE STATE FIRE MARSHAL, COUNTY OR MUNICIPAL FIRE MARSHAL,

FIRE CHIEF, THE BALTIMORE CITY FIRE DEPARTMENT OR OTHER DESIGNATED AUTHORITIES HAVING JURISDICTION (AHJ'S).

(b) NEW INSTALLATIONS – THE BUILDING PERMIT APPLICANT SHALL BE RESPONSIBLE FOR THE PROPER INSTALLATION OF REQUIRED SMOKE ALARMS IN RESIDENTIAL OCCUPANCIES CONSTRUCTED AFTER JULY 1, 2013. THE GENERAL CONTRACTOR SHALL BEAR THIS RESPONSIBILITY WHERE NO BUILDING PERMIT IS REQUIRED.

(c) EXISTING – INSTALLATION AND MAINTENANCE – THE LANDLORD OR PROPERTY OWNER SHALL BE RESPONSIBLE FOR THE INSTALLATION, REPAIR, MAINTENANCE AND REPLACEMENT OF SMOKE ALARMS REQUIRED BY THIS SUB-TITLE.

(d) OCCUPANTS OF A RESIDENTIAL OCCUPANCY SHALL NOT REMOVE OR TAMPER WITH A REQUIRED SMOKE ALARM OR OTHERWISE RENDER THE SMOKE ALARM INOPERATIVE.

(e) TESTING OF REQUIRED SMOKE ALARMS SHALL BE THE RESPONSIBILITY OF THE OCCUPANT OF THE RESIDENTIAL UNIT. A TENANT SHALL NOTIFY THE LANDLORD OF THE FAILURE OR MALFUNCTION OF A REQUIRED SMOKE ALARM. THE LANDLORD SHALL PROVIDE WRITTEN ACKNOWLEDGEMENT OF THE NOTIFICATION AND SHALL REPAIR OR REPLACE THE SMOKE ALARM WITHIN FIVE CALENDAR DAYS OF SUCH NOTIFICATION.

(f) WHERE A RESIDENTIAL UNIT DOES NOT CONTAIN AC ELECTRIC POWER, BATTERY OPERATED SMOKE ALARMS OR SMOKE ALARMS OPERATING ON AN APPROVED ALTERNATE SOURCE OF POWER SHALL BE PERMITTED.

§ 9-106. [Sprinkler systems] PROPERTY INSURANCE CLAIMS

[(a) In general. -- If approved by the State Fire Prevention Commission, an approved automatic fire sprinkler system may be installed instead of a smoke detection system.

(b) Effect on other requirements. -- Installing an approved automatic fire sprinkler system does not nullify the other requirements of the State Fire Prevention Code or exempt an occupancy from other requirements that are clearly applicable under the State Fire Prevention Code.]

FAILURE TO COMPLY WITH THIS SUBTITLE MAY NOT BE USED AS A POLICY DEFENSE IN THE SETTLEMENT OF A PROPERTY INSURANCE CLAIM.

§ 9-107. [Property insurance claims] SMOKE ALARM INSTALLATION ORDER

[Failure to comply with this subtitle may not be used as a policy defense in the settlement of a property insurance claim.]

(a) IN GENERAL – IF THE STATE FIRE MARSHAL OR OTHER DESIGNATED AUTHORITY HAVING JURISDICTION (AHJ) FINDS THE ABSENCE OF OPERATING REQUIRED SMOKE ALARMS, SUCH AUTHORITY SHALL ISSUE A SMOKE ALARM INSTALLATION ORDER TO THE RESPONSIBLE LANDLORD, OWNER OR OCCUPANT.

(b) THE RESPONSIBLE PERSON SHALL COMPLY WITH A SMOKE ALARM INSTALLATION ORDER WITHIN FIVE CALENDAR DAYS.

§ 9-108. [Smoke detection installation order] VIOLATION OF SUBTITLE

[(a) In general. -- If after investigating a fire in a one, two, or three family residential dwelling the State Fire Marshal or local investigating authority finds the absence of required smoke detectors, the State Fire Marshal or local investigating authority shall issue to the occupant a smoke detection installation order.]

(a) PROHIBITED – A PERSON SHALL NOT KNOWINGLY VIOLATE THIS SUBTITLE.

[(b) Failure to comply with order. -- A person may not fail to comply with a smoke detection installation order within 15 days of reoccupancy.]

(b) A PERSON WHO VIOLATES THIS SUBTITLE IS GUILTY OF A MISDEMEANOR AND ON CONVICTION IS SUBJECT TO IMPRISONMENT NOT EXCEEDING THIRTY DAYS OR A FINE NOT EXCEEDING $5,000 OR BOTH.

[(c) Penalty. --

(1) A person who violates subsection (b) of this section is guilty of a misdemeanor and on conviction is subject to a fine not exceeding $ 50.

(2) The penalty provision of § 9-109 of this subtitle does not apply to this section.]

[9-109. Violation of subtitle

(a) Prohibited. -- A person may not knowingly violate this subtitle.

(b) Penalty. -- A person who violates this section is guilty of a misdemeanor and on conviction is subject to imprisonment not exceeding 10 days or a fine not exceeding $1,000 or both.

PROPOSED LEGISLATIVE CHANGES CONTINUED:

Recommendation:

In existing homes it is recommended that alarms be required for any addition or repair work requiring a building permit, except exterior surface work such as re-roofing. Alarms must be interconnected and hard wired. Exception: Alarms will not be required to be interconnected and hard wired where the permit work does not require the removal of interior wall or ceiling finishes unless there is an attic, crawlspace, or basement available where access is provided.

Rational:

This requirement is currently in the *International Residential Code* (IRC); however not every jurisdiction has adopted the IRC or enforces this section

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Recommendation:

Require that when a home is sold that it has the proper smoke detection for when the home was built or last remodeled as well as the installation of smoke alarms in all sleeping rooms and on every level of the home. Proper certification of this requirement shall be contained within the contractual documentation signed at time of property settlement.

Rational:

The Task Force feels that change of ownership provides the best opportunity to assure an existing home meets all of the requirements for appropriate smoke detection. Most existing homes go through an inspection process as part of the negotiation of sale. Further, new residents moving into the State may not be familiar with current smoke alarm laws.

PROPOSED CODE CHANGES

****PLEASE NOTE: CODE CHANGE PROPOSALS ARE UNDERLINED****

NFPA 720 Standard for the Installation of Carbon Monoxide Detection and Warning Equipment – 2012 edition

Section 9.6.3 Multiple-Purpose Alarms

9.6.3.1. A fire alarm signal shall take precedence and be distinctively recognizable over any other signal, even when the non-fire signal is initiated first.

9.6.3.2. There shall be a means of distinguishing the carbon monoxide alarm signal from all other signals.

<u>9.6.3.3. In addition to alarm signal tone patterns, all alarm conditions shall be annunciated by a voice alarm.</u>

Rational: Section 9.6.2 requires the use of a T4 tone signal pattern for carbon monoxide alarm condition. NFPA 72 requires the use of a T3 tone signal pattern for smoke alarm activation. The provisions of 9.6.3 require that signals be "distinctive" however, it is unreasonable for the general public to be able to differentiate the slight differences between the T3 and T4 tone signal patterns. Voice alarm technology is readily available.

NFPA 72 National Fire Alarm Code, 2010 edition

<u>29.3.5.3 A fire alarm signal shall take precedence and be distinctively recognizable over any other signal, even when the non-fire signal is initiated first.</u>

<u>29.3.5.3.1 When a combination smoke alarm – carbon monoxide device is provided, in addition to alarm signal tone patterns, all alarm conditions shall be annunciated by a voice alarm.</u>

Rational: The provisions of NFPA 720 Section 9.6.2 require the use of a T4 tone signal pattern for carbon monoxide alarm condition while NFPA 72 requires the use of a T3 tone signal pattern for smoke alarm activation. The provisions of 9.6.3 require that signals be “distinctive” however, it is unreasonable for the general public to be able to differentiate the slight differences between the T3 and T4 tone signal patterns. Voice alarm technology is readily available.

29.11.1 Add the following sections:

(12) Button colors: Buttons for the control of alarm silencing, testing or temporary sensitivity adjustment shall be provided in contrasting colors to the housing and, in the case of multiple buttons, each other.

(13) Instructional sticker/label: An instructional sticker/label shall be provided with the device packing materials that sets out basic information regarding regular testing, battery replacement (when pertinent) and device replacement, and other routine maintenance. The installation instructions shall specify that the instructional sticker/label be to be installed by the installer in a conspicuous location within the living unit, such as the cover of the electrical panel or inside of kitchen cabinet door.

Rational: Providing contrasting colors of operational buttons, will enable the user to more clearly determine which controls are to be used. The instructional sticker/label provides a method for improving the living unit’s occupant’s awareness of the required testing, maintenance and replacement requirements.

PROPOSED MANUFACTURER CHANGES

Recommendation: Changes to Smoke Alarm Packaging

Recommend that the following information be prominently shown on the outside of the Smoke Alarm Packaging:

- Manufacture date
- End of Life date
- Type of power source

Rationale:

Current packaging often makes it difficult, if not impossible for the public to make informed choices when purchasing smoke alarms. Displaying the above information on the outside of the packaging will eliminate that problem. In addition, the Task Force recommends the following items be included inside the packaging:

- A sticker to be placed in some prominent location with information related to periodic testing and replacement date.
- Information explaining the operation of the hush/silence feature.

This additional information will assist the building occupants to recognize the importance of regular periodic testing and eventual replacement of all smoke alarms.

Recommendation: Changes to Smoke Alarm Marking

Recommend the following changes be made to smoke alarm exterior housing:

- Marking of control buttons shall be in letters of contrasting color from the smoke alarm housing and large enough to be read from the floor (assuming a floor to ceiling distance does not exceed nine feet). If more than one control button is provided, each shall have its own distinctive color.
- Provide hush/silence feature on all alarms.
- End of life date shall be shown in contrasting color.

Rationale:

The Task Force believes that providing the above information on the outside of the smoke alarm housing will assist in the proper testing and utilization of the hush/silence feature. Periodic testing will assist with informing residents of the presence and condition of the battery.

Most of the items listed above are already requirements of *NFPA 72, National Fire Alarm and Signaling Code ©.* The changes recommended will make this information available before purchase and make them accessible for the homeowner/resident without having to climb a ladder or remove the alarms to read the back. We also feel that if testing and silencing procedures are easy to recognize and understand, it will encourage the homeowner/resident to properly test and use their alarms.

Recommendation: Sealed Long Life Battery Smoke Alarms

Recommend that whenever a "battery only" smoke alarm is permitted to be used, the alarm must be the type that contains a long life sealed battery as its power source.

Rationale:

The vast majority of fire deaths every year occur in residential properties, with either inoperable alarms or no alarms present. This Task Force feels it is imperative to advocate for the use of long life battery smoke alarms when a battery only device is called for. This is also included in our legislative recommendations. A long life battery resolves the replacement issue by providing an uninterrupted power supply for the life of the smoke alarm.

Recommendation: Hush/Silence Feature on All Smoke Alarms

Recommend that <u>all</u> smoke alarms sold in the State of Maryland shall be provided with a hush/silence feature.

Rationale:

This function allows the alarm to be silenced after a small smoke event such as burnt toast without the removal of the battery. After a set period of time, usually 5 to 8 minutes, the alarm resets and is fully functional eliminating the potential permanent inoperability of the alarm because the battery was not reinstalled

EDUCATION ADVOCACY AND PUBLIC OUTREACH

Recommendation :

Create a Standing "*Smoke Alarm Advisory Committee*"

The State Fire Marshal should appoint a standing "Smoke Alarm Advisory Committee". Appointed members of the Committee shall be from such organizations as the Maryland Regional Fire Marshals Sub-Committee, State Fire Marshal staff, Maryland State Firemen's Association, State Fire Prevention Commission, Maryland Building Officials Association, Maryland Legislative Fire Service Caucus, homebuilders, home owner associations, the real estate industry and other appropriate stakeholders as may be determined from time to time by the State Fire Marshal.

The purpose of the Committee shall be to continuously review and evaluate changing residential smoke alarm and detection technologies. The Committee shall also make recommendations to the State Fire Marshal on how best to incorporate smoke alarm improvements; code enforcement issues; public safety education, firefighter training and other factors into current day technologies through research, education and state or national code or legislative changes. Any proposed changes to national codes should be vetted through the NFPA/IFMA Regional Code Development Committee and the ICC Regional Code Development Committee as a means to develop support and consensus among fire service and code authorities to help ensure success of such proposals.

The proposed Committee shall identify and review the scope and general effectiveness of current smoke alarm installation/inspection and enforcement programs. They shall recommend ways that State and local fire service and other related fire safety or civic organizations and government agencies can cooperate more effectively to ensure that smoke alarms are properly installed and operating in all dwellings regardless of their occupancy type or legal status.

Rationale:

According to a report published by NFPA, almost all households in the U.S. have at least one smoke alarm, yet in 2005-2009, smoke alarms were present in less than three-quarters (72%) of all reported home fires and operated in half (51%) of the reported home fires. ("Homes" includes one- and two-family homes, apartments, and manufactured housing.) More than one-third (38%) of all home fire deaths resulted from fires in homes with no smoke alarms, while one-quarter (24%) resulted from fires in homes in which smoke alarms were present but did not operate.

The death rate per 100 reported fires was twice as high in homes without a working smoke alarm as it was in home fires with this protection. Hardwired smoke alarms are more reliable than those powered solely by batteries.

In Maryland, the latest statewide fire death analysis by the State Fire Marshal's Office for CY 2011 indicated that smoke alarms operated properly in only 35% of the fatal fire incidents. In 19% of the cases they could determine that no alarm was present. In 38% of the cases they could not determine if an alarm was present. In 7.5% of the cases they determined that an alarm was present but did not operate for whatever reason.

Clearly, ensuring that all homes in Maryland have properly installed and operating smoke alarms is and should be a continuing priority for the fire service and other fire safety related organizations. However, it has proven to be a challenge to develop and implement cooperative programs in this regard, and code enforcement powers are very limited, especially in privately owned dwelling units that make up a majority of the dwelling units.

The State Fire Marshal's Office, local fire departments and other organizations have programs whereby they will provide and/or install free smoke alarms to anyone who requests one, or where they may discover that no smoke alarm is present as a result of a fire call, EMS call, courtesy home inspection, or neighborhood canvas immediately after a nearby fire event. However, it appears that the effectiveness of these programs vary across the state, depending on funding, staffing and other resources.

In addition, some local jurisdictions require that when a building permit is issued, or when homes are sold or new tenants move in, that an occupancy inspection must be conducted or a certificate must be issued verifying that properly located and operating smoke alarms are present upon completion of the new work or change of

ownership/tenancy. However, such programs are not uniformly required or consistently enforced in all jurisdictions.

While these programs are well intended and provide a valuable public service, and there is little doubt they have helped save lives; it is evident that much more needs to be done. The question is how can these programs be made even more effective and consistent and, what can be done on a broader statewide basis to help ensure that all homes in Maryland are equipped with properly located and operating smoke alarms?

Accordingly, the Committee shall identify and review the scope and general effectiveness of current smoke alarm installation/inspection and enforcement programs and recommend ways that State and local fire service and other related fire safety or civic organizations and government agencies can cooperate more effectively to ensure that smoke alarms are properly installed and operating in all dwellings.

Recommendation: Smoke Alarm Education for Fire Departments

● Recommend training for new firefighters, and advanced training for both firefighters and line officers, shall include current smoke alarm information. Such information to include:

- Types of available acceptable smoke alarms
- Optimum location and placement of smoke alarms
- Differing code requirements due to the age of the home
- New features that various smoke alarms offer
- Replacement criteria for the various smoke alarms available

● Recommend that Fire Departments develop a smoke alarm document specific to their local codes and regulations to ensure that information that is reaching the homeowner is accurate.

Rationale:

Fire and Rescue Personnel are frequently the *only* smoke alarm "experts" the general public will meet. These meetings are most often during or immediately following an emergency requiring the professional services of the Fire or Rescue personnel. The opportunity for a positive safety impact (vis-à-vis installing appropriate smoke alarms) is

short due to the emotionally charged conditions that required the services of the Fire and Rescue Personnel. These First Responders must have complete and accurate information concerning the proper installation of smoke alarms if their advice to homeowners is to be effective. The following recommendations are intended to assure that the First Responders do possess that complete and accurate information.

Recommendation: Use Media Outlets to address the concerns of dissemination of current events and advisories through email, it is the opinion of the Task Force to utilize the established system of the Office of the State Fire Marshal media Google mail account. The OSFM has developed a system for contacting media outlets throughout Maryland and neighboring states through the use of this operating account. Along with the traditional campaigns such as: *"Change Your Clocks – Change Your Batteries"*, general releases addressing smoke alarms issues are performed on an at will basis. An additional campaign can be readily established with a more aggressive push by incorporating the Maryland State Firemen's Association along with local fire departments supporting the cause within hours of gaining new information.

Recommendation: Provide **a Website** to promote access to information gathering and updates, the Office of the State Fire Marshal and the Maryland State Firemen's Association have developed a website involving fire and life safety information on one centralized website. The website established for this purpose is: www.mdlifesafety.org. It is recommended this site be the officially supported central point of dissemination of fire and life safety information.

Recommendation: Use Social Media to promote access to improved smoke alarm technologies, both the Office of the State Fire Marshal and Maryland State Firemen's Association have established Facebook accounts. Information provided about smoke alarm installation and use will be continuously updated to meet advancements in

technology on both organizations pages. It is recommended to continue support of the OSFM / MSFA outreaches to inform, promote, and provide details of fire and life safety information and programs through social media outlets.

Recommendation: Develop a State Level Smoke Alarm Installation Program with a central location with 24 hour monitoring, such as the Maryland Joint Operations Center, to receive smoke alarm requests to be disseminated to all appropriate jurisdictions. Depending on their abilities and participatory level for operating smoke alarm programs a definitive timeframe for fulfilling an installation request is difficult to determine. Career, urban and rural companies throughout the State have differing capabilities and may not have the resources to effect immediate response.

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- Maryland State Firemen's Association
- Montgomery County Fire & Rescue Service, Maryland
- National Fire Academy
- National Fire Protection Association
- National Institute of Science and Technology
- Underwriters Laboratories
- United States Fire Administration
- Universal Security Instruments

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