

Developing a Smoke Alarm Program in Goshen (OH)

Paul C. Hasenmeier III

Goshen Fire and EMS, Goshen, Ohio

CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of other is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: Lee C. Johnson

Abstract

The problem is that Goshen Fire and EMS has not identified a means to decrease the number of missing and non-operating smoke alarms in one and two family dwellings in Goshen, Ohio. The purpose of this research was to determine a means to decrease the number of missing and non-operating smoke alarms in one and two family dwellings in Goshen, Ohio. The descriptive research method was used to answer the following research questions. a) Why do people not install or maintain smoke alarms in one and two family dwellings? b) What are national recommendations for installing and maintaining smoke alarms in one and two family dwellings? c) How do other fire departments of similar size address the installation and maintenance shortcomings of smoke alarms in one and two family dwellings? d) What is the cost-benefit of each alternative identified? The literature review identified reasons why people do not install and maintain smoke alarms. Additionally, the literature review examined multiple sources identifying industry standards and internal procedures for the installation and maintenance of smoke alarms including Vision 2020. Fire departments from across Ohio were interviewed to determine what others are doing to install and maintain smoke alarms. Interviews with the Fire Chief and Fire Prevention Lieutenant were conducted to determine current smoke alarm installation practices, program marketing, and challenges faced. All combined, the results of the research showed that the current smoke alarm activities do not provide the community with satisfactory risk reduction even though their intent may be plausible. Lastly, the research was presented to Fire Chief Steve Pegram and Firefighter Cody Martin for use in community risk reduction with a recommendation to evaluate and create a new smoke alarm program for Goshen Township Fire and EMS.

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Developing a Smoke Alarm Program in Goshen, Ohio

“An estimated 1,600 fatal fires in residential buildings were reported to United States fire departments each year and caused an estimated 2,495 deaths, 625 injuries, and \$188 million in property loss” (U.S. Department of Homeland Security, 2013, p. 1). A high percentage of the fatalities occur between the hours of 11 p.m. and 7 a.m. when most people are sleeping. The problem is that Goshen Fire and EMS has not identified a means to decrease the number of missing and non-operating smoke alarms in one and two family dwellings in Goshen, Ohio. The purpose of this research was to determine a means to decrease the number of missing and non-operating smoke alarms in one and two family dwellings in Goshen, Ohio. The descriptive research method was used to answer the following research questions. A) Why do people not install or maintain smoke alarms in one and two family dwellings? B) What are national recommendations for installing and maintaining smoke alarms in one and two family dwellings? C) How do other fire departments of similar size address the installation and maintenance shortcomings of smoke alarms in one and two family dwellings? D) What is the cost-benefit of each alternative identified?

This research will seek to determine why people do not install or maintain smoke alarms, what the national standards and recommendations for installation and maintenance of smoke alarms focuses on, and what the cost-benefit of those alternatives will provide to the community. David Davis (2004) stated that “helping the homeowner learn and understand the importance of smoke detectors is vital to getting a detector in every home as well as maintaining them once they are installed” (p. 16). If Davis is

correct, the research will reveal deficiencies in the Goshen Fire and EMS program and provide potential opportunity for greater risk reduction.

Background and Significance

In 1947, the Goshen Community Fire Department was formed, which was an all-volunteer private fire company. At the time, Goshen Township was predominately a rural farming community, however, has seen a shift over the years towards a more suburban bedroom community. The Goshen Community Fire Department and the Goshen Township Life Squad served the citizens of Goshen Township until 1997 when Township Trustees decided that it would be best for the two departments to merge and form Goshen Township Fire and EMS. The proud history and mission of the organization has continued through emergency and non-emergency operations that include, but are not limited to: fire suppression, emergency medical services (EMS), hazardous materials, rescue, commercial building fire inspection, and public education. This organization is a combination department that has 14 full-time members and 50 part-time members that play an integral role in daily and emergency operations. The department has one deputy chief, three captains, and three lieutenants under the supervision of the fire chief.

Critical Hazard Protection

Goshen Fire and EMS services a population of approximately 16,375 permanent residents within Goshen Township (Clermont County Economic Development, 2012). The jurisdiction has a combination of residential, commercial, and assembly occupancies in addition to large areas of land used for agricultural purposes and other areas of steep

topography. Some critical infrastructure that Goshen Fire and EMS protects within its jurisdiction includes:

- Goshen Local School District. Four buildings on one campus providing education for pre-kindergarten through 12th grades.
- O'Bannon Creek Golf Club. A championship 18 hole golf course with a 16,000 square foot clubhouse.

Additionally, State Route 28 is a state highway which connects several manufacturing and transportation hubs with Interstate 275. Much of the truck traffic is packaging, parts, and jet fuel to support the Wilmington airport and the surrounding manufacturing and shipping facilities the Cincinnati metro area. Lastly, there are two gas transmission pipelines which cross the township, a telephone switching location, and several residential water and sewer treatment facilities.

Geographic Location

Goshen Township is located in Clermont County, Ohio and spans 34.4 square miles on the northeast side of the Cincinnati metropolitan area (City-Data, 2015). The majority of the township's land area is rural, which has contributed to the lack of fire hydrants and long response times. Additionally, the road system is comprised of many narrow, hilly, and winding roads.

Programs and Services

The researcher identified the following core programs provided to the Goshen Township residents and visitors, as well as the services that enable the agency to deliver their core programs:

Table 1: Core Programs

Emergency Medical Services	Fire Suppression
Rescue – Basic and Technical	Fire Prevention
Fire Inspection	Public Fire and First Aid/CPR Education
Hazardous Materials Mitigation	

Table 2: Support Services

Training	Communications
Logistics	Budget
IT	Health/Wellness
Township Legal	Township Fiscal Clerk
Goshen PD / Clermont County Sheriff's Office	Division of State Fire Marshal
Ohio Department of EMS	Mutual Aid
Electric Utilities	Gas Utilities
Township Trustees	Clermont County Dispatch
Water & Street Departments	Goshen Local Schools
Township Administration	Building Official
Great Oaks Career Center	Ohio Fire Academy
Goshen Fire and EMS Medical Director	Clermont County EMA
Greater Cincinnati Hazmat	Other State Agencies

Importance

The lack of a smoke alarm program has left residents without guidance on the need, installation, and maintenance of smoke alarms. Presently, the outreach to the community is status quo, as smoke alarms are installed in residences when requested. This research project is important to the community so a smoke alarm program can be better aligned with the department's mission to prevent fire and serious injury through comprehensive education and prevention programs (Goshen Fire and EMS, 2015).

This applied research project relates to the Executive Analysis of Community Risk Reduction course that "intends to help establish a national focus on community risk reduction" (USFA, 2013, p. SM 1-3). Furthermore, the problem is not isolated to Goshen Fire and EMS; it is found throughout the fire service. Smoke alarm programs are directly

linked to the United States Fire Administration (USFA) strategic goal 1, “reduce risk at the local level through prevention and mitigation (USFA, 2012) and the Executive Fire Officer Program (EFOP) Class 2 Community Risk Reduction, Unit 2: Assessing Community Risk.

Literature Review

There is an obvious effort by many fire departments to promote working smoke alarms in residences to bring an awareness that they save lives. Unfortunately, between 2009 and 2011, 82 percent of fire deaths occurred in residential buildings (USDHS, 2013). To further understand the risk, efforts must include understanding the people element as a means to solving the problem. The key to community risk reduction programs is to change long term behavior of the occupants – just installing smoke alarms is not the solution (Vision 20/20, 2015).

The literature review for this applied research project was performed utilizing resources from the National Fire Academy’s Learning Resource Center, Goshen Fire and EMS, and various web resources. Furthermore, books, journal articles, reports, and several Executive Fire Officer Applied Research Projects were reviewed. Interviews with Goshen Fire and EMS personnel and interviews with community risk reduction personnel from other departments in Ohio were conducted. Attempts were made to use the most current resources while realizing some dated information still provided valuable insight.

The Goshen Township smoke detector and carbon monoxide distribution program release from liability form (Appendix A) outlines a resident’s agreement to installation and/or testing. This form serves a purpose to document the resident’s understanding of

responsibility to keep the smoke alarm in working condition and that Goshen Fire and EMS is not responsible for the maintenance of the alarm.

The City of Oxford, Ohio mandates the installation of single or multiple station smoke alarms in Group R occupancies (City of Oxford, 2014). This includes each sleeping area, outside each sleeping area, and on each level of the residence.

Furthermore, their property maintenance code specifies that the alarms must be photoelectric type. “Ionization smoke alarms are generally more responsive to flaming fire, whereas, photoelectric smoke alarms are generally more responsive to fires that begin with a long period of smoldering” (NFPA, 2014, p. 1).

In 2013, the Cincinnati City Council approved legislation requiring that all rental properties have photoelectric smoke alarms installed outside of sleeping quarters (City of Cincinnati, 2013). Furthermore, they required property owners to inspect the alarms annually and when executing a new lease agreement, and report findings to the fire department. The Cincinnati Fire Department recommends using both ionization (more responsive to flaming fires) and photoelectric (generally more responsive to smoldering fires) alarms for best protection.

Almost all households in the U.S. have at least one smoke alarm, yet from 2000-2004, smoke alarms were not operating or were intentionally disabled in almost half (46%) of the reported home fires. Nearly all of the non-working smoke alarms were due to dead or missing batteries. Despite the almost universal presence of smoke alarms in homes, research on smoke alarms installed in home has shown that many alarms are disabled by the occupants because of frequent nuisance alarms from cooking. As many as 20 percent of the smoke alarms

installed in the U.S. homes have been disabled, and that number may be higher in high risk areas, such as inner cities and rural communities. (Lee & Pineda, 2010, p. v)

The Seattle Fire Department uses a variety of methods to market their smoke alarm program, including: print and online media targeted to the library system, parks and recreation, and senior services. “One of the most successful ways of reaching people who need smoke alarms is by doing door-to-door canvassing” (Mace, 2010, p. 3).

Kehoe (2010) evaluated the Haines City Fire and Rescue’s residential smoke alarm installation program and found that 227 homes had smoke alarms installed over the course of 13 years. Her research showed “that the current program requires modifications and enhancements to become more efficient and effective” (Kehoe, 2010, 32). Specific recommendations for modification include: tracking the number of smoke alarm installed versus those that are distributed, how the educational materials are delivered, and conducting home safety surveys.

The Ohio Division of the State Fire Marshal’s Office provides regulations and standards that reference the Ohio Fire Code (OFC).

The Ohio Fire Code has no retroactive requirement to install smoke detectors in single family dwelling units. There are some retroactive smoke detector requirements but they are only applicable to those “R” residential occupancies specifically referenced in the code. One, two and three family dwellings are not one of the “R” residential occupancies referenced in the OFC. For new construction, Ohio has adopted the 2006 Residential Code of Ohio. It does contain specific requirements for smoke detector installations, in all sleeping

rooms, outside each separate sleeping area and on each level of the home. (USFA, 2010, p. 68)

Installation guidelines in Ohio for smoke alarm placement include: test your smoke detector monthly, change the batteries in your smoke alarm twice yearly, install a smoke alarm on each level of your home and inside sleeping areas, have a home fire escape plan, sleep with your bedroom door closed, have a working smoke alarm on every level of your home (USFA, 2010).

The Life Safety Code permits battery-powered smoke alarms in existing dwellings, gives dwelling occupant's relief from retrofit requirements while providing needed protection (NFPA, 2000). However, occupants of dwellings that use battery-operated smoke alarms must ensure that they are tested and maintained properly. Furthermore, smoke alarms need to be positioned correctly. "If they are too close to a wall/ceiling intersection, particularly over a door, air currents might cause heat and smoke to bypass the unit completely" (NFPA, 2000, p. 289).

The National Fire Protection Association reiterates the primary reason other agencies share for smoke alarm failure in homes. The battery is often removed to avoid nuisance alarms. NFPA public education programs, such as the *Learn Not to Burn* program, are effective tools for promoting proper smoke alarm maintenance (NFPA, 2000).

The most significant human factor contributing to fatalities in residential structures indicated that 44.9 percent of fatalities were the result of being asleep (USFA, 2012, table 2). Additionally, the most significant activity of the civilian prior to death was attempting to escape (USFA, 2012, figure 7).

Goshen Fire and EMS Chief Steve Pegram and Lieutenant Chris Johns were asked to explain the history of the organizations efforts to install and/or promote the importance of smoke alarms within the jurisdiction. Both expressed a financial challenge with purchasing more smoke alarms to install and an even a bigger concern for the lack of maintenance of residential smoke alarms by residents. In past years, the organization received grant funding for the purchase of smoke alarms. Goshen Fire and EMS personnel went door to door installing the smoke alarms, however, poor documentation prevents knowing exactly where this “smoke alarm blitz” was completed. From memory, Chief Pegram said “the crews canvased the four local mobile home parks that contain over 450 mobile homes” (personal communications, April 6, 2015). Both Pegram and Johns relayed that the mobile home parks have been areas without working smoke alarms. Additional outreach to children in preschool through fourth grade occurs annually during fire prevention week in the Goshen Local Schools.

Both Chief Pegram and Lieutenant Johns spoke from memory about remembering multiple instances of residents narrowly escaping residential structures on fire due to the complete lack of or inoperable smoke alarms. One fire resulted in a male occupant receiving burns over 40 percent of his body. He was woken by a barking dog instead of a working smoke alarm and was hospitalized at the University of Cincinnati Burn Center. In another fire, an adult female was woken by a window breaking from the fire. Fortunately, she was able to escape with her five children, unharmed.

Chief Pegram also discussed two incidents resulting in the loss of life that have occurred in Goshen Township over the past 8 years. The first was in the early morning hours of August 4, 2007 when a 21 year old male was unable to escape a residential

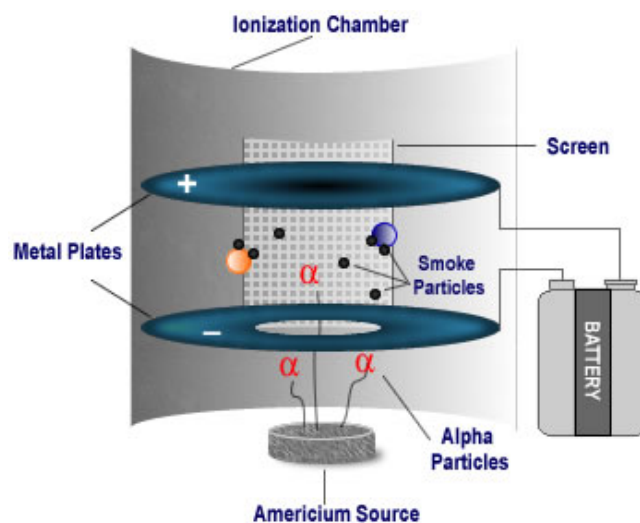
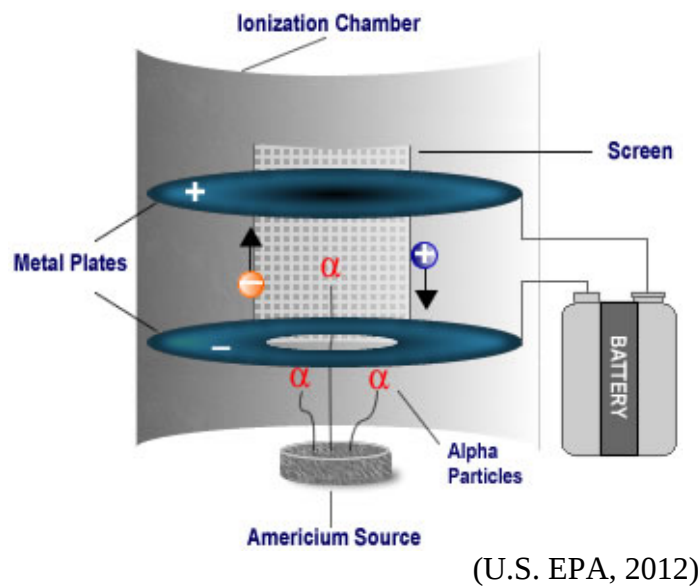
structure with significant fire involvement upon fire department arrival (Goshen Fire and EMS, 2007). The second incident on February 5, 2015 at 06:57 hours occurred while the researcher was at the National Fire Academy for year two of the Executive Fire Officer Program. This incident resulted in the death of a male occupant found in a basement bedroom that violated current building and fire codes (Goshen Fire and EMS, 2015). Smoke alarms were not present near where the victim was found in the 2007 incident and were not in or near the sleeping quarters in the basement of the 2015 incident.

Interviews were conducted with fire department chiefs and fire prevention personnel from eleven fire departments from across the State of Ohio. A combined answer of those interviews found a host of smoke alarm program activities (Appendix C). They include: fire prevention talks, smoke alarm giveaways at community events, 5th grade student giveaways, door-to-door canvassing, request only installation, for-purchase options, education in the schools, social media press releases, and elderly outreach.

Walz (2010) recommends to make a concerted effort to better interact with community leaders and groups as well as faith based organizations in order to reach and educate residents. She further explains that the Pittsburgh Bureau of Fire must recognize that a positive image is earned and not assumed.

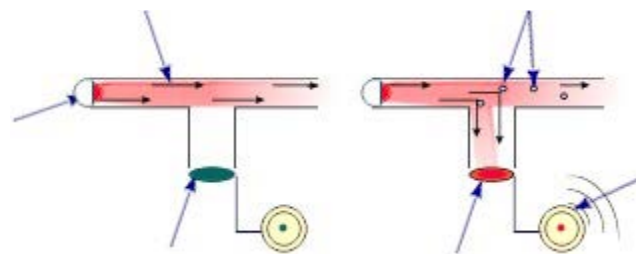
“The technologies used in available smoke alarms include ionization and photoelectric detection. Ionization smoke detection is more responsive to invisible particles produce by most flaming fires. Photoelectric smoke detection is more responsive to visible particles produced by smoldering fires” (Richardson & Roux, 2012, p. 792).

The diagrams below illustrate how ionization technology works. The positive atoms flow toward the negative plate, as the negative electrons flow toward the positive plate. The movement of the electrons registers as a small but steady flow of current. When smoke enters the ionization chamber, the current is disrupted as the smoke particles attach to the charged ions and restore them to a neutral electrical state. This reduces the flow of electricity between the two plates in the ionization chamber. When the electric current drops below a certain threshold, the alarm is triggered. (U.S. Environmental Protection Agency, 2012)



(U.S. EPA, 2012)

Photoelectric technology smoke alarms use a T-shaped chamber fitted with a light-emitting diode (LED) and a photocell. The LED sends a beam of light across the horizontal bar of the chamber. The photocell sits at the bottom of the vertical portion of the chamber. The photo cell will generate a current, when exposed to light. The diagram below illustrates how the technology works. Under normal, smoke-free conditions, the LED beam moves in a straight line, through the chamber without striking the photo cell. When smoke enters the chamber, smoke particles deflect some of the light rays, scattering them in all directions. Some of it reaches the photocell. When enough light rays hit the photocell, they activate it. The activated photocell generates a current. The current powers the alarm, and the smoke alarm has done its job. (U.S. EPA, 2012)



(U.S. EPA, 2012)

Except for installations near cooking appliances, the requirements of NFPA 72 do not specify the type – ionization or photoelectric – of smoke alarm to be used. An ionization smoke alarm is generally more responsive to flaming fire, and a photoelectric smoke alarm is generally more responsive to smoldering fires. (Richardson & Roux, 2012, 793)

In addition to the reasons for smoke alarms and types of alarms available, a cost-benefit analysis of the specific policy decision-making in regards to a smoke alarm

program may be necessary. Before beginning a cost analysis, the framework for conducting the analysis must be established. This consists of identifying the nature of the problem, clarifying the alternatives that will be considered, identifying the audience for the analysis, and selecting which cost analysis to use (Levin & McEwan, 2001).

When analyzing a specific policy, several components must be considered. First, the policy's positive and negative social consequences must be identified. Second is the monetary valuation of as many of the consequences as social benefits and costs as possible. Third is the application of the appropriate decision criterion to weigh the social benefits and costs and assess the policy's efficiency. (Fuguitt & Wilcox, 1999)

Within the cost-benefit analysis, the costs of training, retraining, quality control, equipment, administration, and other expenses should all be considered (Lerner et al, 2007). One aspect of cost-benefit analysis that addresses notions of equity during the analysis has to do with attempting to quantify intangible and indirect cost and benefits. This is a very subjective part of the analysis and as Clemons and Mcbeth (2012) state, "it is impossible to quantify most of what government does" (p. 290). The numbers in a cost-benefit analysis could be skewed in an effort to push a project forward or hamper its progress, however, the equity in a sound analysis should produce a prescribed course of action.

Dunn (2012) describes "an equitable policy as one for which effects (e.g., units of service or monetary benefits) or efforts (e.g., monetary costs) are fairly or justly distributed" (p. 200). So, overall a policy may not progress even if the benefits outweigh the cost because of an "inequitable distribution" (Dunn, 2012, p. 200). Some examples of

this disproportion includes; “those most in need don’t receive the services, those who are least able to pay or bear a disproportionate share of costs, or those who receive most of the benefits do not pay the costs” (Dunn, 2012, p. 200). A team instead of an individual should determine placing a price on the intangible benefits so the policy can be as equal as feasible.

In summary, the literature review has given the researcher an opportunity to review the reasons smoke alarms may not be installed or maintained, the smoke alarm activities of Goshen Fire and EMS, what other fire departments in Ohio do, the different types of smoke alarms, and why a cost-benefit analysis may be needed for a new program.

The literature presents evidence that there are many different reasons for the lack of operational smoke alarms, two main types of smoke alarms, and evidence for program cost-benefit analysis. Strategically implementing a program that reduces risk to the community and meets fiscal responsibilities will be key components of the discussion and recommendations.

Procedures

This research paper is formatted following the American Psychological Association Publication Manual, 6th Edition. The research methodology used to answer the research questions was descriptive research.

The procedures utilized for this research were designed to answer the four research questions: a) Why do people not install or maintain smoke alarms in one and two family dwellings? b) What are national recommendations for installing and maintaining smoke alarms in one and two family dwellings? c) How do other fire

departments of similar size address the installation and maintenance shortcomings of smoke alarms in one and two family dwellings? d) What is the cost-benefit of each alternative identified? Research was initiated at the National Fire Academy's Learning Resource Center in February of 2015. Attempts were made to use the most current resources while realizing some dated information still provided valuable insight.

To answer research question a) the following procedures were utilized: a literature review of Federal Emergency Management Agency, National Fire Protection Agency, and other peer-reviewed literature was used to provide insight into the reasons people do not install or maintain smoke alarms in one and two family dwellings. Internal interviews with Fire Chief Steve Pegram and Lieutenant Chris Johns were conducted to determine if they saw any trends in why residents of Goshen Township do not install or maintain smoke alarms.

To answer research question b) the following procedures were utilized: a comparison of National Fire Protection Association standards, building codes, Vision 20/20, and municipal standards was the main process used to determine installation and maintenance procedures.

To answer research question c) the following procedure was utilized: interviews were conducted with 10 fire prevention personnel on June 2, 2015 and June 10, 2015 from ten Ohio fire departments with similar populations to Goshen Fire and EMS.

Interview Question Development and Interviewee Selection Procedures:

The interview questions (Appendix B) were developed with the assistance of fire service consultant Dr. Thomas Poulin (biography – Appendix D). The questions were

field tested on a group of Executive Fire Officer Program students on February 5, 2015 while at the National Fire Academy.

Ohio fire departments with populations not more than 30,000 were determined by contacting Erica Schortegen (member services coordinator for the Ohio Fire Chief's Association), who emailed the researcher the association's database of Ohio fire department demographics. Contact information for the Ohio Fire Chiefs' Association was readily available on their website: www.ohiofirechiefs.com.

To answer research question d) the following procedures were utilized: a literature review of peer-reviewed public administration materials was used to establish how organizations and fire departments perform cost-benefit analysis. Furthermore, the cost-benefit analysis procedures were used to analyze information collected and make recommendations to better meet the needs of the community.

Assumptions and Limitations

After reviewing the Goshen Fire and EMS smoke alarm education and installation activities, it was discovered that no data is available and no baseline for measuring the effectiveness of the program can be determined. Much of the internal information gathered was through interviews with the Fire Chief and Lieutenant in charge of public education.

Another limitation that should be acknowledged in the development of this applied research project is that the interview results could have been significantly different or sought different information. The researcher has limited experience in interview question writing, data compilation, and expressing said data in graphic format.

Sufficient cooperation by fire officials during the interviews improved accuracy and eliminated the researcher from drawing conclusions, which was an initial unknown.

Results

For each of the four research questions, procedures sought internal and/or external insight and data. The first question was answered by reviewing literature and through the interviews originally thought to answer only question three. The literature showed that cooking fires cause many nuisance alarms that result in residents removing batteries or alarms from operation. “Despite the almost universal presence of smoke alarms in homes, research on smoke alarms installed in homes has shown that many alarms are disabled by the occupants because of frequent nuisance alarms from cooking” (Lee and Pineda, 2010, p. v).

From the interviews, Goshen’s Fire Chief Steven Pegram and Lieutenant Chris Johns provided insight to the fact that there have been numerous instances of inoperable working smoke alarms in residences that they have responded to. Many of these have been in the four mobile home parks within Goshen, while others have been scattered across the jurisdiction in homes dating prior to building codes requiring hard-wired smoke alarms. Although unexpected for this question, several responses in the interviews of other fire departments indicated that cities with new construction and high economic status tend to have less instance of nonoperational smoke alarms.

The second question for this applied research project was answered with a literature review of national standards, municipal standards, and building codes. A very compelling standard shows that “Ionization smoke alarms are generally more responsive

to flaming fire, whereas, photoelectric smoke alarms are generally more responsive to fires that begin with a long periods of smoldering” (NFPA, 2014, p. 1). The City of Oxford, Ohio mandates the installation of single or multiple station smoke alarms in Group R occupancies (City of Oxford, 2014). This includes each sleeping area, outside each sleeping area, and on each level of the residence. Furthermore, their property maintenance code specifies that the alarms must be photoelectric type.

The research shows that ionization and photoelectric type smoke alarms are the primary alarms that are installed in single family homes to be in compliance with codes and standards. Research by Feng and Milke (2012) shows that ionization-based smoke alarms are more likely to react to nuisance sources than photoelectric smoke alarms. “Thus, reducing the number of nuisance alarms in ionization-based alarms is projected to keep more smoke alarms in service which should lead to a further reduction in the number of fatalities in residential homes” (Feng and Milke, 2012, p. 3).

The third questions for the applied research project was answered with interviews of fire department personnel from ten different fire departments in Ohio with similar populations to Goshen Township. The smoke alarm program activities that other departments perform are wide-ranging and seem to be fined-tuned for the individual community based on response from the residents. All of the activities from the interviews are contained in Appendix C, however, a summary list includes:

- Education talks in local schools
- Public relation (PR) details at local businesses
- Smoke alarm giveaways at PR details, school events, and/or firehouse visitors
- Door-to-door canvassing for smoke alarm installation

- Funding from various grants
- Most programs are installing 10 year lithium-ion battery smoke alarms
- Senior citizen smoke alarm installation programs
- Print, social media, television, and radio marketing of smoke alarm programs

For question four, literature was reviewed on cost-benefit analysis processes. The costs of purchasing smoke alarms are standard so-to-speak, but the amount of time to market a program and install smoke alarms is variable. One aspect of cost-benefit analysis that addresses notions of equity during the analysis has to do with attempting to quantify intangible and indirect cost and benefits. This is a very subjective part of the analysis and as Clemons and Mcbeth (2012) state, “it is impossible to quantify most of what government does” (p. 290). The tangible results of saving a life compared to the expenses of a smoke alarm program will be difficult to determine. There is no exact recommendation learned through the literature review to determine the emotional or perceptual benefit to the cost of a smoke alarm program. So, overall a policy may not progress even if the benefits outweigh the cost because of an “inequitable distribution” (Dunn, 2012, p. 200).

Discussion

The following compares the results of this applied research to the literature review, discusses agreements/disagreements, and highlights implications for Goshen Fire and EMS. First, when comparing the insight from Chief Pegram and Lieutenant Johns to the reasons people don’t have operational smoke alarms that the literature review revealed, similarities as to why residents don’t install and/or maintain smoke alarms can be seen. The researcher does sense a bit of disagreement from the literature when

compared to internal insight of the organization regarding at least one smoke alarm being present in homes in the U.S.

After reviewing the Goshen Fire and EMS smoke alarm activities, it was discovered that no data is available and no baseline for measuring the effectiveness of the program can be determined. The insight collected internally is from the recollection of events over time by several interviewed individuals. Additionally, a comparison of economic and education status between Goshen and other communities was not completed for this project, but may be a contributing factor to why smoke alarms are not operational. The amount of time to measure the smoke alarm programs effectiveness of reducing risk in Goshen will be challenging due to limited personnel and not having a dedicated risk reduction staffer.

Second, when looking at the standards for smoke alarm installation and maintenance, a clear-cut benefit was outlined from the results of the literature review. Photoelectric smoke alarms are optimal for smoldering fires in and around sleeping areas. Nearly all literature suggests using this type of detector with 10-year lithium-ion batteries in homes that don't require a retrofit to hardwired systems, such as new construction. Rightfully so, this type of power supply will prevent battery replacement or removal issues for the life of the detector. Even, the City of Oxford, Ohio outlines that photoelectric smoke alarms are required in its property maintenance code. There are some cities including Cincinnati, that recommend both photoelectric and ionization smoke alarms be installed in one and two family dwellings. With technology, this dual purpose smoke alarm is available from numerous manufacturers. The implications to

Goshen Fire and EMS include the need to standardize the type of detector procured and installed.

Third, the interviews of fire department personnel from ten different fire departments in Ohio provided numerous ideas for smoke alarm program activities. These ideas coupled with NFPA programs like “Learn Not To Burn” will provide a solid foundation for Goshen Fire and EMS to build a more impactful smoke alarm program as compared to previous years. Some of the ideas that seem to be immediate opportunities provided the funding is available include: door-to-door canvassing, school education, community public relation events, and senior resident networking via churches. Ultimately, Goshen Fire and EMS should realize “that the current program requires modifications and enhancements to become more efficient and effective” (Kehoe, 2010, p. 32). The researcher did find it surprising that none of the departments interviewed mentioned data collection to evaluate their programs. The theme appears to be to saturate the community with smoke alarms the best funding can supply.

Lastly, placing a dollar amount on a life is and has always been a challenge for safety service organizations. Furthermore, there is supportive evidence found in other programs that captures specific data to measure the effectiveness of a program. It is recognized that capturing the data needed to measure this type of program will take several years to see if a smoke alarm program is being successful. Johnson asks “are we serving our communities well, if we fail to respond to the data associated with smoke alarms relating to the financial costs and lives lost from residential fires” (Johnson, 2013, p. 37). Although Goshen Fire and EMS has seen the tragic effects from the lack of operational smoke alarms, the benefits of having them in relation to cost is currently

immeasurable due to the lack of data. As data is collected, further evaluation of the program's cost-benefits should be taken into consideration when seeking funding and planning activities.

Recommendations

The current smoke alarm activities of Goshen Fire and EMS have shown instances of perceived failure due to resident injury and causality. These failures should not be placed entirely on Goshen Fire and EMS or any organization without placing equal or greater blame on the individual residents involved.

Goshen Fire and EMS can work to reduce the risk to the community by developing a more powerful smoke alarm program. Installing smoke alarms without collecting data to measure the effectiveness of the program does not provide direction as to what the risk actually is to the community or what area of the community is most vulnerable.

Research into developing a smoke alarm program for Goshen Fire and EMS resulted in the following recommendations:

1. Create a program that instructs and inspires the community to take action.
2. Establish how smoke alarm activities are going to be recorded for future data analysis.
3. Ensure Goshen Fire and EMS personnel understand Life Safety Code 101 recommended smoke alarm installation procedures and mounting locations.
4. Seek funding sources by means of a Goshen Fire and EMS community risk reduction budget line item, local donations and fundraisers, and state and federal grants.

5. Utilize newspapers, radio, television, social media, and local business marketing to disseminate smoke alarm program information.
6. Investigate billboard advertising on a highly traveled roadway.
7. Consider community group meetings for program presentations.

All of these recommendations seek to reduce the risk of injury and death of Goshen Township residents. By implementing these recommendations, a more prepared fire and EMS department staff will be much more influential in promoting and implementing the smoke alarm program.

Future research on this topic is recommended to effectively evaluate whether the new program has an impact on the fire and EMS department and the community. During this research, it should be determined if the number of residences with operational smoke alarms increases or decreases, if the crews are more effective at documenting and conducting the program, and if negative consequences or positive results occurred after implementation.

References

- City-Data. (2015). *Goshen, Ohio*. Retrieved from <http://www.city-data.com/township/Goshen-Clermont-OH.html>
- City of Cincinnati. (2013). Property owner photoelectric smoke alarm inspection form. Retrieved from <http://www.cincinnati-oh.gov/fire/safety-prevention/smoke-alarms/>
- City of Oxford. (2014). *City of Oxford property maintenance code*. Retrieved from http://www.cityofoxford.org/sites/default/files/comm_dev/Property-Maintenance-Code-2013-with-2014-Amendments.pdf
- Clemons, R. S., & McBeth, M. K. (2009). *Public policy praxis: A case approach for understanding policy and analysis* (2nd ed.). Indianapolis, IN: Prentice Hall.
- Clermont County Economic Development. (2012). *Community report*. Retrieved from <http://www.clermontcountyohio.biz/Goshen+Township+Community+Report.pdf>
- Davis, D. H. (2004). *Encouraging the use of residential smoke detectors*. Emmitsburg, MD: National Fire Academy.
- Dunn, W. N. (2012). *Public policy analysis* (5th ed.). Boston. Pearson.
- Feng, J. T. & Milke, J. A. (2012). *Analysis of the response of smoke detectors to smoldering fire and nuisance sources*. Retrieved from http://strategicfire.org/wp-content/uploads/2015/04/4707_USI_Milke_Report_final1.pdf
- Fuguitt, D., & Wilcox, S. J. (1999). *Cost-benefit analysis for public sector decision makers*. Westport, CT: Quorum Books.

- Goshen Fire and EMS. (2007). *6502 Snider road fire report*. Goshen, OH. Goshen Fire and EMS.
- Goshen Fire and EMS. (2015). *Goshen fire and EMS standard operating procedures*. Goshen, OH. Goshen Fire and EMS.
- Goshen Fire and EMS. (2015). *1381 Stella drive fire report*. Goshen, OH. Goshen Fire and EMS.
- Johnson, B. R. (2013). *Developing a smoke alarm program for St. George fire protection district*. Emmitsburg, MD: National Fire Academy.
- Kehoe, E. S. (2010). *Evaluating Haines city fire and rescue's residential smoke alarm installation program*. Emmitsburg, MD: National Fire Academy.
- Lee, A., & Pineda, D. (2010). *Smoke alarms-pilot study of nuisance alarms associated with cooking*. Retrieved from <http://www.cpsc.gov/PageFiles/98679/smokealarmnuisance.pdf>
- Lerner, E., Nichol, G., Spaite, D., Garrison, H., & Maio, R. (2007). A comprehensive framework for determining the cost of an emergency medical services system. *Annals of Emergency Medicine*, 49, No. 3, 304-313.
- Levin, H.M., & McEwan, P.J. (2001). *Cost-effectiveness analysis methods and applications* (Second ed.). Thousand Oaks, CA: Sage Publications, Inc.
- Mace, B. (2010). Smoke alarm installation program evaluation. Retrieved from <http://www.seattle.gov/fire/pubed/Publications/PreventionPrograms/EvaluationReportSmokeAlarms.pdf>
- National Fire Protection Association. (2000). *Life safety code handbook*. National Fire Protection Association. Quincy, MA.

National Fire Protection Association. 2014. Ionization vs photoelectric. Retrieved from

<http://www.nfpa.org/safety-information/for-consumers/fire-and-safety-equipment/smoke-alarms/ionization-vs-photoelectric>

Richardson, L. F. and Roux, R. J. (2012). *National fire alarm and signaling code handbook*. National Fire Protection Association. Quincy, MA.

U.S. Department of Homeland Security. (2013). Fatal fires in residential buildings (2009-2011). *Topical Fire Report Series, 14(3)*, 1-12. Retrieved from <https://www.usfa.fema.gov/downloads/pdf/statistics/v14i3.pdf>

U.S. Environmental Protection Agency. (2012). Ionization technology. Retrieved from http://www.epa.gov/radiation/sources/smoke_ion.html

U.S. Environmental Protection Agency. (2012). Photoelectric technology. Retrieved from http://www.epa.gov/radiation/sources/smoke_photo.html

U.S. Fire Administration. (2010). Smoke alarms save lives. Retrieved from http://www.ajfire.org/uploads/smoke_alarm_requirements.pdf

U.S. Fire Administration. (2012). *Civilian fire fatalities in residential buildings (2008-2010)*. Emmitsburg, MD: Federal Emergency Management Agency.

U.S. Fire Administration. (2012). Strategic plan. Retrieved from <http://www.usfa.fema.gov/about/strategic/>

U.S. Fire Administration. (2013). *Executive analysis of community risk reduction* [Student manual, 2nd ed, 4th printing]. Emmitsburg, MD: Author.

Vision 20/20. (2015). Human behavior. Retrieved from <http://strategicfire.org/education-outreach/human-behavior/>

Walz, C. (2010). *Addressing smoke detector coverage in the Larimer neighborhood*.

Emmitsburg, MD: National Fire Academy.

Appendix A



**THE GOSHEN TOWNSHIP FIRE DEPARTMENT
SMOKE DETECTOR AND CARBON MONOXIDE DISTRIBUTION
PROGRAM**

Release From Liability

I, _____,
(please print name)

have agreed to the installation of this

- ☐ carbon monoxide detector(s)
☐ smoke detector(s)

have agreed to install and test this

- ☐ carbon monoxide detector(s)
☐ smoke detector(s)

myself or get another capable person to do so for me.

I have also been given instructions on the use of the detector(s). I agree that I will not bring any claim against the Goshen Township Fire Department, its employees, agents, volunteers or the Goshen Township Trustees for any damages resulting from the use of this smoke detector(s) and /or carbon monoxide detector(s). further, I will indemnify and hold harmless the Goshen Twp. Fire Dept., its employees, agents, volunteers, and the Goshen Twp. Trustees in the event any claim is brought by me or on my behalf by any member of my family for any damages resulting from the use of this smoke detector and/or carbon monoxide detector. This agreement is binding on my heirs, successors, or assigns.

I understand that if a detector(s) is provided, it is my responsibility to keep the detector(s) in working condition, and that the Goshen Twp. Fire Dept. and the Goshen Twp. Trustees are not responsible for the maintenance of the detector(s).

I understand and agree that the safety equipment provided by the Goshen Fire Dept. is done as a public service in the interest of health and safety and that the Goshen Fire Dept. is not a dealer in safety equipment nor are they agents for any manufacturer or distributors of such equipment.

Date

Applicant's Signature

Date

Fire Department Representative

White- Fire dept.

Yellow- customer

Appendix B

Ohio Fire Department Smoke Alarm Program Interviews

Date:

Department:

Population:

Annual Budget / Community Risk Reduction Budget:

Interviewee/Title:

1. Do you have a smoke alarm program?
2. What does your program consist of?
3. What parts of the program work well?
4. What parts of your program have been ineffective?
5. What would you do to improve your program if you had additional funding?

Appendix C

Ohio Fire Department Smoke Alarm Program Interview Answers

The following people and agencies participated in the interviews:

1. Deputy Chief Keith Brickner – American Township Fire Department (Elida, OH)
Population – 27,000
2. Captain Page – Ashtabula (OH) Fire Department. Population – 19,000
3. Chief Doug Ayers – St. Marys (OH) Fire Department. Population – 8,500
4. Firefighter Anthony Coletta – Ashland (OH) Fire Department. Population –
22,000
5. Captain Dan Syden – Maple Heights (OH) Fire Department. Population – 23,000
6. Chief Mike Warner – Concord Township (OH) Fire Department. Population –
20,000
7. Lieutenant Keith Watson – Marysville (OH) Division of Fire. Population –
23,300
8. Fire Inspector Lynn Reline – Twinsburg (OH) Fire Department. Population –
22,000
9. Chief Jeff Klein – Perrysburg (OH) Fire Department. Population – 22,000
10. Fire Inspector Todd Wolf – Solon (OH) Fire Rescue. Population – 23,000

The following is a combined list of answers to each question the interviewees were asked:

1. **Do you have a smoke alarm program?** Unofficial, yes, yes, yes, yes, yes, yes
(Lt. runs the program), yes, yes, yes, yes.

2. **What does your program consist of?** Fire prevention talks, Home Depot and Lowes PR events (the businesses give away smoke alarms), we give away smoke alarms, give smoke alarms to 5th graders annually (the Union supports this with a fundraiser), door-to-door (FEMA funding), pass out smoke alarms, install smoke alarms when requested, always have smoke alarms on apparatus, every home owner/occupant gets one smoke alarm and can purchase up to three more for \$2, smoke alarms can be picked up or installed by request, State of Ohio Fire Marshal grant funding for smoke alarms, public education through the schools in the month of May, grant funded, residents call to request smoke alarms, install 10 year lithium ion smoke alarms, county senior services provide and install smoke alarms for persons 60 years old (+) upon request (no program for non-seniors), FEMA grant funding, stock hearing impaired smoke alarms, grant funding for 500 smoke alarms, waiver form.
3. **What parts of the program work well?** Good reception in the schools, smoke alarms are checked in apartment common spaces during inspections, Firefighter Phil program, saturation of the community, some residents use the smoke alarms we install or give out, the program is limited in scope, local newspaper ads work well, announcements are made in public meetings about the smoke alarm program, people know they can talk to the fire department and receive help with smoke alarms, township news letter marketing, residents call in regularly, resident's compliance, social media, billboard advertisement by senior services, local newspaper advertisement, fire department website, not many fires, a lot of

new construction (50% of homes are hardwired), residents have an above average education resulting in a higher economic status.

4. **What parts of your program have been ineffective?** Nothing, 50% of residents live in rentals, prevention trailer, no follow-up, half of the homes in the jurisdiction don't have smoke alarms, funding, nothing (no recent fires without smoke alarms), <20% of residences without smoke alarms, school education, funding at times.

5. **What would you do to improve your program if you had additional funding?** Program is working well and we don't have many residences without smoke alarms, give out more smoke alarms, additional smoke alarms and batteries on station, funding for more resident outreach, buy more smoke alarms, nothing, find a way to regularly check smoke alarms on EMS runs or by following up afterwards, keep in stock smoke alarms, find more ways to keep the kids in the community involved, more education, teach firefighters more about the types of smoke alarms.

Appendix D

Fire Service Consultant Biography**Dr. Thomas Poulin:**

Academic: Have taught at the university level at several institutions. Currently teach public safety leadership, concentrating on leadership, emergency management, homeland security and research course in the graduate and doctoral programs at Capella University. Have taught courses in emergency management and disaster policy, public policy, and a course on the relationships between business, government and society in the NASPAA-accredited MPA program at Old Dominion University. Have taught emergency management in the public sector for NASPAA-accredited Nova Southeastern University's MPA program. Have taught organizational psychology and organization development in the undergraduate human resource administration programs at the University of Richmond, and organizational psychology, research methods and leadership in the masters program in human resource management at the same institution. Have taught executive development, executive leadership, organizational theory, and interpersonal dynamics at the Department of Homeland Security's National Fire Academy.

Professional: Served for over thirty years in local emergency management agencies, retiring as a Battalion Chief from a metro-sized fire department. Hold, or have held, certifications as Fellow of the Institution of Fire Engineers, Executive Fire Officer Program Graduate, Chief Fire Officer Designee, Fire Officer III (VA), Associate Emergency Manager (VA), Fire Instructor IV (VA), Fire Inspector II (VA), Emergency Medical Technician-B (VA), and Cardiac Rescue Technician (MD). Specialties: (1)

Emergency Management and Disaster Policy (2) Executive Development and Leadership, (3) Program Evaluation, (4) Research Methods

Publications: Have published in professional and academic journals, and presented research findings at the annual conferences of the American Society for Public Administration, the American Political Science Association, the Southern Political Science Association, the Virginia Social Science Association, and the Southeast Conference for Public Administration.