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ABSTRACT

Law Enforcement agencies are charged with investigating and prosecuting fires and Arson related crimes. Fire and Arson Investigators have not always utilized forensic science to investigate fires. The old investigation methods that have been invalidated by science must be discarded and when investigating fires only proven scientific evaluation should be utilized. Law enforcement Agencies should ensure arson investigators are properly trained in forensic arson science and maintain that level of training. Proper utilization of forensic arson science utilized during investigations will eliminate fire investigations, myths, wise tails, and folklore that have been handed down over the years from investigator to investigator. Also Fire investigators should be required to meet training and continuing education standards related to National Fire Protection Association Standards 1033 (Standard for Professional Qualifications for Fire Investigator) and NFPA 921 (Guide for Fire and Explosion Investigations). Law enforcement agencies must ensure their investigators learn and utilize these new forensic arson standards and maintain their training so that when conducting investigations, it will eliminate false arrests and prosecutions that are based on unproven or unreliable data and evidence. Ensuring that the guilty party is properly charged and prosecuted and the case is backed on scientifically proven facts will also ensure false convictions and show that expert witness testimony is based on provable facts instead of false science.

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INTRODUCTION

Fire and arson investigations have not always been based in the forensic methods. For many years the typical fire investigator was instructed and trained by senior seasoned arson investigators. The learning occurred on the job and the seasoned investigator passed along their knowledge that was based on years of on the job experience. It unfortunately was sometimes based on myths and ideas that some now call folklore, wise tails, and junk science. Investigators have now learned these non-forensic science-based ideas from investigating fires for years, and from ideas that were shared as facts, but have been disproven as scientific in nature, and are not accurate indicators to determine the cause and origin of the fire (Hanson, 2015, p. 3).

Recent court cases and review of arson cases by experts have shown that people have been falsely accused of arson, and convicted of arson, based on non-scientific based investigations (Augenstein, 2015; French, 2017; Stephen & Plummer, 2014). According to Lentini (2013), arson investigators must base all their investigations on current forensic science principals, and the current accepted practices in the fire investigation field (p. 18). The Texas Forensic Science Commission and the Texas Fire Marshal's Office have also determined a path to ensure these mistakes do not happen, with a report of recommendations regarding best practices for arson investigation. (TX Forensic Science Commission, 2011)

Currently based on the Texas Forensic Science Commission's evaluation and retroactive case reviews by the Texas Fire Marshal's Office, there have been a number of convictions overturned including the high-profile cases of Cameron Todd Willingham and Ernest Ray Willis. Willingham was executed by lethal injection and Willis was

released from prison after his exoneration. Since the findings of the Texas Forensic Science Commission, based on the reports produced by the Forensic Science Commission and the recommendations they published in the report, the Texas State Fire Marshal's Office is collaborating with the Texas Forensic Science Commission to change the way they conduct fire investigations in the state.

The Texas State Fire Marshal's Office has formed a Science Advisory workgroup made up of industry experts to conduct retroactive reviews of all the cases the Texas State Fire Marshal's Office currently has conducted and any reports of false arson convictions in Texas brought forward by the Texas Innocence Project (Texas State Fire Marshal's Office and the Texas Forensic Science Commission, 2011). Arson investigators must ensure they are investigating fires correctly using scientific principles. False or misleading forensic evidence has no place in arson investigation and there is currently no excuse for investigators to utilize these old methods of investigation. Law enforcement agencies should ensure arson investigators are properly trained in forensic arson science and maintain that level of training.

POSITION

Fire investigators are currently under an increasingly high amount of scrutiny and the training, education, and experience required to properly investigate fires can be stressful. Fire Investigators should be a certified fire investigator (CFI) at a minimum, and utilize the scientific method, National Fire Protection Association (NFPA) Standards 921, and 1033 to conduct their investigations (Almirall & Furton, 2004; DeHann, 2007). Investigators should be properly trained in forensic arson science methods to eliminate

some passed down mistakes such as fire investigation myths, wise tails, and folklore (Lentini, 2012; Texas Forensic Science Commission, 2011).

There are some common myths and misconceptions that have created issues in fire investigations according to Hanson (2015) and Lentini (2007). This was propagated by the publishing of the 1977 Law Enforcement Assistance Administration booklet titled Arson and Arson Investigation: Survey and Assessment. This booklet taught fire investigators these common myths and presented them as facts of accelerant utilization during fires. These myths include alligatoring, crazed glass, depth of char, lines of demarcation, sagging furniture springs, spalling, fire load, low burning and holes in the floor, V-patterns, and time and temperature. Alligatoring occurs on charred wood creating an alligator skin look. When this occurs the large blister appearance supposedly indicates rapid intense heat and when you see small alligatoring it indicates low heat with no accelerant (Hanson, 2015; Lentini, 2012; Lentini, 2007).

Crazing or crazed glass is a myth that is said to occur where irregular cracks form in glass due to rapid heating from an accelerant being utilized. Depth a char and lines of demarcation are myths that are utilized to determine the point of origin of the fire based on their appearance, the investigator can tell if accelerants were utilized. Sagging furniture springs are another wise tail that has long been taught was an indication of arson. The sagging occurs at 1150F, so with this high heat, and the insulated nature of furniture, the fire got too hot to not be accelerated. Concrete, brick or cement spalling is said to occur when intense heat from an accelerant being poured on them creates them to spall, there will also typically be brown stains around the spalling. Some other myths including fire load (fuel load), low burning and holes in the

floor, V-patterns, and time and temperature are also myths that have all been disproven as absolute indicators of arson (Hanson, 2015; Lentini, 2012; Lentini, 2007).

These myths are still being utilized by investigators that have been trained to look for them based on dated training methods that were not formulated in forensic arson science instruction (Hanson, 2015; Lentini, 2012; Lentini, 2007). The only clear way to eliminate many of these myths is to utilize NFPA 921 as a guide to every investigation and ensure that all investigators are required to attend a recertification training. These trainings should be conducted by a state or national certifying body such as the International Association of Arson Investigators (IAAI) or National Association of Fire Investigators (NAFI) to ensure they are brought up to date on current standards and best practices of forensic arson science investigation (Texas Forensic Science Commission Report, 2011).

If all current fire investigators ensure a level of training that will eliminate the false and misleading types of evidence that many false convictions have been based upon, investigators can ensure they are doing their job correctly. Texas high profile cases based on the issues of false information regarding fire investigation have created a huge media frenzy, along with a high-profile death row execution in 2004 of Cameron Todd Willingham that some arson investigation experts say was Texas executing an innocent man (Giannelli & Gawel, 2011, p. 1245). According to Hanson (2015), Han Tak Lee was convicted in 1989 utilizing some of the same misleading and false evidence as Willingham.

Another Texas case where exoneration occurred, involved Ernest Ray Willis, who was convicted and served many years on death row and was subsequently

released due to the misleading evidence that was found to be based on myths and wise tails (Texas Forensic Science Commission Report, 2011). All arson investigators must be trained in current scientific methods of forensic arson investigation to ensure they are properly determining the fire causation (Giannelli & Gawel, 2011, p. 1245), and (Lentini, 2012). While ensuring that the elimination of incorrect forensic arson science is a best practice and great first step in the elimination of the problem, Fire Investigators should be required to utilize NFPA 921 when conducting Fire Investigations and, meet the training and continuing education of National Fire Protection Association (NFPA) Standard 1033 (DeHaan, 2007; Lentini, 2013; Texas Forensic Science Commission, 2011).

The NFPA Standard NFPA 921 Guide for Fire and Explosion Investigations should be utilized as a basis for any Fire Investigation that is conducted (Lentini, 2013). The National Fire Protection Association (NFPA) in 1992 developed Guide for Fire and Explosions NFPA 921 (NFPA921) which was based on scientific principles of arson investigation. When this standard came out it clearly delineated the future of arson investigation. NFPA 921 is utilized by both prosecutors and defense attorneys as the standard to evaluate expert witness testimony regarding cause and origin fire investigations. NFPA 921 clearly states in Chapter 4, Basic Methodology “The systematic approach recommended is that of the scientific method, which is used in the physical sciences” (NFPA 921, 2014, p. 921-19).

NFPA 921 makes it clear that it is the standard to be utilized in developing their cases. NFPA 921 clearly delineates that cases must be based on scientific principles and data, instead of the past practices of on the job training and experiences alone.

NFPA 921 clearly defines that cases that are based on myths and folklore which has been scientifically disproven with forensic science is not acceptable as part of fire investigations. Learning from experienced investigators is important, as their experience is invaluable, but making sure the knowledge gained is based on solid forensic science and NFPA 921 guidelines will ensure investigators cases are accepted by prosecutors and the courts.

According to the National Registry of Exonerations (French, 2017) there were nationally, 63 arson convictions that were exonerated since 1991. This is a significant number of people who were falsely convicted and serving time in prison, based on testimony related to faulty forensic arson science. These findings regarding arson convictions and exonerations should give arson investigators a concern and reinforce the fact that they need to ensure they are basing their investigations on NFPA 921 scientific standards. If the fire investigator fails to utilize NFPA 921 in their investigation, the attorneys and the courts may not only allow them to testify as an expert witness but because of recent findings in court trials regarding false and misleading science, create a situation in which their case and investigation findings and opinions may be thrown out of court altogether.

Along with ensuring they are following the guidelines of NFPA 921 in investigations, the development of continued education requirements following the Standard for Professional Qualifications for Fire Investigator National Fire Protection Association 1033 (NFPA 1033) is important. NFPA 1033 details the job performance requirements (JPRs) necessary to maintain continuing certification as a fire investigator in both the private and public sectors (NFPA 1033, 2014). Investigators should maintain

knowledge of all the JPRs recommended by NFPA 1033 at a minimum of every 3 years. NFPA 1033 also identifies the job performance requirement for all fire investigators at both public and private levels (NFPA 1033, 2014). This will ensure their continued knowledge and training will be maintained and allow the fire investigator to stay current with evolving updates in Forensic Arson Science.

Without following the NFPA1033 continuing education guidelines, fire investigators risk losing their continued expertise required to maintain expert witness qualification by keeping current with latest recommended best practices in the field (Hanson, 2015; Texas Forensic Science Commission, 2011). National Fire Protection Association Standard for Professional Qualifications for Fire Investigator NFPA 1033 standards are a measure that attorneys and courts utilize when determining expert witness qualifications (NFPA1033, 2014). These standards apply equally to any fire investigator regardless of private or public employment. NFPA 1033 specifically defines that Investigators “should remain current with investigation methodology, fire protection technology, and code requirements by attending workshops and seminars and/or through professional publications and journals”. (NFPA 1033, 2014, p. 1033-6).

The NFPA 1033 standard also details that investigators should have up to date basic knowledge of 16 specific topics and their minimum level of knowledge should be to the post-secondary education level. These topics include (1) Fire science, (2) Fire chemistry, (3) Thermodynamics, (4) Thermometry, (5) Fire dynamics, (6) Explosion dynamics, (7) Computer fire modeling, (8) Fire investigation, (9) Fire analysis, (10) Fire investigation methodology, (11) Fire Investigation technology, (12) Hazardous Materials, (13) Failure analysis and analytical tools, (14) Fire Protection Systems, (15) Evidence

collection, documentation, and preservation, and (16) Electricity and Electrical systems. (NFPA 1033, Standard for Professional Qualifications for Fire Investigator, 2014). Fire Marshals supervising fire investigators should assure that NFPA 921 and 1033 are being followed in case investigations and should make sure the methodologies their investigators utilize are based on solid scientific proven and validated forensic arson science.

If it is not followed during the investigation, they risk the evidence and testimony being disallowed in court (Texas Forensic Science Commission, 2011). NFPA 921, Guide for Fire and Explosion Investigations are also utilized frequently by attorneys to cross examine expert testimony of fire investigators and are citied in court decisions regarding arson cases, and expert testimony related to these cases. It should be utilized along with the requirements of NFPA 1033 by Fire Investigators to ensure they are following standard practice and as a standard for any fire investigation conducted (Lentini, 2012).

COUNTER ARGUMENTS

Forensic arson science training is sometimes costly depending on the investigators current level of training. One of the barriers to specialized training many agencies face in times when budgets are constrained are training costs. The multiple disciplines, highly scientific, and specialized topics that must be trained upon, and post-secondary educational level of training as described by the National Fire Protection Association (NFPA 1033, Standard for Professional Qualifications for Fire Investigator, 2014) creates some cost and time constraint issues for department's budgets.

Many departments do not have the time or training budgets to devote the proper amount of time to highly specialized training such as described by Scheer (2014). Although there are costs and time that must be dedicated to forensic arson training, the easiest solution to solving these issues are online training courses. The highly specialized training related to forensic arson science courses are available for no cost to investigators on websites such as cfitrainer.net. These web-based arson classes are provided and developed by a federal grant administered through the International Association of Arson Investigators, that allows investigators the flexibility and time to take these courses within recommended time frames and continue to serve their community without having to incur high costs for the training required (Lentini, 2012). Many police and forensic science courses are becoming available in this format and the investigator can take these classes anywhere they have access to a computer or iPad, making them convenient and easy to log on and take at their convenience (Geiman 2011).

One Texas Fire Marshal's Office is embracing the Texas Forensic Commissions Report. Fire Marshal David Brannon of the Pasadena Fire Marshal's Office in Pasadena, TX is making sure his investigators have the training they need to be on the forefront of forensic arson investigation (Stelloh, 2013). The Texas Commission on Fire Protection requires twenty hours of annual continuing education with one hour in investigation if you are specifically assigned investigation duties. Pasadena takes a dramatic departure from this minimal level with most of their investigators receiving an average 600 hours of forensic training every year (Stelloh, 2013). All though Pasadena has costs incurred with these classes, they have utilized local classes organized by their

agency which reduced costs significantly and allowed them to bring in forensic arson training classes.

Another issue that many opponents of forensic arson science state as a concern is the requirements to utilize National Fire Protection Association standards NFPA 921 and 1033 and continually maintain the recertification in the subjects of 1033 (NFPA 1033, Standard for Professional Qualifications for Fire Investigator, 2014) (Texas Forensic Science Commission, 2011). Their main argument is that NFPA standards in many states are recommended practices and not requirements to maintain that state's certification. Texas Arson certification under the Texas Commission on Fire Protection (TCFP) does not require NFPA 1033 and the Commission has not adopted it as a requirement for investigators to remain certified. This is a factor that some arson investigators utilize to excuse additional forensic arson science requirements and continued training in NFPA 1033 (Lentini, 2012).

There are currently court Daubert challenges regarding exclusion of investigators because they could not qualify as an expert witness due to their lack of training in NFPA 921 and 1033 (Giannelli & Gawel, 2011). Although this is a fact, one area they are not taking into consideration is that to testify as an expert witness in court cases, you will be asked by attorneys and courts if you are up to date on your training and have been utilizing the national standards that NFPA 921 and 1033 detail for expert testimony qualification in your investigation. If you currently do not abide by these minimum standards that are accepted nationally by leading arson investigation associations and state agencies, you will jeopardize your status as an expert witness (DeHann, 2010).

RECOMMENDATION

As Law enforcement agencies, we must train our investigators in forensic arson science and ensure that level of training. The idea of arson forensic science is not something drastically new but has recently come to the forefront in the arson investigation community. One of the leaders of this change has been arson investigators, but the Texas change has occurred with the findings of the Texas Forensic Science Commission and the Texas Fire Marshal's Office (Texas Forensic Science Commission, 2011). The major cases exonerating two death row inmates in Texas, Willingham, and Willis and the findings of the Texas Forensic Science Commission have set new standards in Texas for the forensic arson science field.

Arson Investigators must as an investigation community embrace these changes and ensure that they are leading the charge to correctly identify the cause and origin of fires and ensure that they have the scientific evidence for the arson crimes they are charging suspects with. Professionals must ensure that they are correctly identifying the cause factors and basing them on forensic arson science. Law Enforcement Agencies are a part of this new standard and must ensure that their investigators learn these new forensic arson science techniques and maintain the training by following nationally accepted standards of training. Cost and time will always be factors in regards to training but utilization of low cost methods and finding free sources are solutions for these issues.

Agencies can utilize continuing education and verified testing, along with online programs and state arson conferences to provide and verify that fire investigators are meeting the standards of the current forensic science requirements and NFPA 921 and

1033 standards. Conducting Practical Scenarios in which basic concepts and scientific evidence collection and forensic arson science concepts can be explored in a trading environment that is hands on will be beneficial to investigators learning concepts and standards. NFPA 1033 is comprised of 16 subjects that all current and new investigators must initially learn and understand thoroughly. Along with the initial education, investigators must continually remain current on these subject areas by attending formal education courses, workshops, and seminars and/or studying formal professional publications and journals to ensure our continued acceptance by the legal community as expert witnesses. Education and training of fire investigators should be done with more realism and incorporate the facts that myths, wise tales and folklore information are not accurate indicators. NFPA 921 and NFPA 1033 standards will only be enhanced in the future and must be utilized during the arson investigation process. The best way to ensure your continued utilization and qualification as an expert witness, while eliminating concerns regarding forensic arson practices in cases is to make sure NFPA standards are adhered to and followed.

The scientific method should be a basis for every investigation and the implementation of NFPA 921 in every investigation should be the standard that investigators follow. The effects of following these requirements on the success of fire investigators in the future and determining if the enhanced training improves the fire origin and cause determination should be further studied. Many of the myths that have been taught to investigators were promulgated by the National Fire Academy and other fire training organizations based on the Academies training.

Many of the problems occur because of the lesson's investigators learned while at the National Fire Academy in their training and the myths that were inadvertently taught by this government organization that has high standing in the field. Many training organizations no longer teach these myths but many investigators who were falsely taught these indicators still follow them, and there are numerous texts lining the bookshelves in their offices that are full of misinformation due to the old techniques and information that has continued to be passed down over the years. Many investigators received their certification and have never looked back or attempted to stay up to date with the evolving trends in the field. There are even speakers that are inadvertently still utilizing misinformation in their talks to students and conferences in the field of fire investigation (Lentini, 2007).

There is still a long way to go to improve the problems in the forensic arson science field and improve the investigations occurring. The national associations such as the International Association of Arson Investigators and the National Association of Fire Investigators have made strides to reduce the misinformation by educating their members. Some are doing their part to improve the issues of misinformation. Until there are some standards to improve the certification and continuing education requirements in each state, the only gatekeeper of flawed investigation will be the judges of the court system and the defense attorney's that have become experts in the field of forensic arson science.

REFERENCES

Almirall, J. R., & Furton, K. G. (2004). *Analysis and interpretation of fire scene evidence*. Boca Raton: CRC Press.

Augenstein, S. (2015). Virginia man fully pardoned of childrens' arson murders after 21 years behind bars. Forensic Magazine, Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/1777468963?accountid=7065

DeHaan, J. D., & Kirk, P. L. (2010). *Kirks fire investigation*. Upper Saddle River, NJ: Prentice Hall.

French, L. (2017). AAAS report points out flaws in forensic fire science, offers suggestions for improvement. *Forensic Magazine,* Retrieved from https://ezproxy.shsu.edu/login?url=https://search-proquest-com.ezproxy.shsu.edu/docview/1925594588?accountid=7065

Geiman, D. (2011). Online training: A high-quality, cost-effective solution. Corrections Today, 73(2), 14-17. Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/894256572?accountid=7065

Giannelli, Paul C; Gawel, Kimberly. Criminal Law Bulletin; Boston Vol. 47, Iss. 6, (Nov/Dec 2011): 1241.

Hansen, M. (2015, 12). BADLY BURNED. ABA Journal, 101, 37-43. Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/1759173766?accountid=7065

Lentini, J. J. (2007). THE MYTHOLOGY OF ARSON INVESTIGATION. Retrieved November 6, 2017, from http://www.firescientist.com/Documents/NewOrder/2006%20The%20Mythology%20of%20Arson%20Investigation-John%20Lentini.pdf

Lentini, J. J. (2012). The evolution of fire: Investigation and its impact on arson cases. *Criminal Justice, 27*(1), 12-17, 61. Retrieved from https://ezproxy.shsu.edu/login?url=https://search-proquest-com.ezproxy.shsu.edu/docview/1010401530?accountid=7065

Lentini, J. J. (2013). *Scientific protocols for fire investigation*. Boca Raton, FL: CRC.

NFPA 921: guide for fire and explosion investigations. (2014). Quincy, MA: National Fire Protection Association.

NFPA 1033: Standard for professional qualifications for fire investigator. (2014). Quincy, MA: National Fire Protection Association.

Scheer, C. (2014). Adaptive expertise in police work: The role of in-service training (3631342). Available from Criminal Justice Database. (1564765501). Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/1564765501?accountid=7065

Stelloh, T. (2013, November 20). With hundreds of hours of training, investigators combat arson with science. Retrieved November 2, 2017, from https://www.nbcnews.com/news/other/hundreds-hours-training-investigators-combat-arson-science-f2D11624976

Stephen, J. M., & Plummer, C. (2014). AN ARSON PROSECUTION: Fighting fire with science. Criminal Justice, 28(4), 4-11. Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/1507290698?accountid=7065

Texas Forensic Science Commission (Ed.). (2011, April 15). *WILLINGHAM/WILLIS INVESTIGATION* (Rep.). Retrieved November 2, 2017, from Texas Forensic Science Commission website: www.fsc.texas.gov/sites/default/files/FR_Willingham-Willis%20w%20Addendum%2010312011.pdf

Texas State Fire Marshal's Office and the Texas Forensic Science Commission. (n.d.). Retrieved November 2, 2017, from https://www.tdi.texas.gov/fire/fmfsc.html

Victor, W. W. (2010). Ask experts about forensic certification and accreditation. Criminal Justice, 25(1), 48-51. Retrieved from https://ezproxy.shsu.edu/login?url=https://search.proquest.com/docview/521206576?accountid=7065