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Recovery of Human Remains in a Fatal Fire Setting Using Archaeological Methods

Gregory Olson
B.A. M.Sc

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Principal Author

Original signed by Gregory Olson, B.S.M.Sc.

Office of the Ontario Fire Marshall

Approved by

Original signed by Steve Palmer

Executive Director Canadian Police Research Centre

Approved for release by

Original signed by Mark Williamson

Chair: Centre for Security Science Document Review Panel

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Abstract

The aim of this study is to assist fire investigators in understanding the value of the application of archaeological recovery methods at fatal fire scenes. It also is intended to provide insight into the essential skills utilized in these methods. The anticipated outcome can be to increase the amount of human remains recovered along with more associated artifacts surrounding the death and, thereby, improve the quantity and quality of critical evidence. It is anticipated that this study will have a positive impact within the forensic community in the investigation of fire fatalities.

There is an understandable tendency for those involved in fire settings to become overwhelmed at the magnitude and destruction of the scene itself. Fire investigations are often complex and difficult to interpret, and, at fires where the loss is large, there is a potential problem that the investigator may become overpowered, fixated or pre-occupied, and, therefore, fail to take the necessary judicious steps. To avoid these serious situations, it is imperative to develop an analytical and systematic approach to scene investigation.

Résumé

Cette étude a pour but d'aider les enquêteurs sur les incendies à comprendre la valeur de l'application de méthodes de récupération archéologique sur les lieux où un incendie mortel s'est produit. Elle vise aussi à mieux comprendre les compétences essentielles utilisées dans ces méthodes. On pourrait accroître la quantité de restes humains récupérés de même que celle des artefacts qui entourent la personne décédée et, par conséquent, améliorer la quantité et la qualité des preuves critiques. On s'attend à ce que cette étude ait des conséquences positives dans la communauté médico-légale en matière d'enquête sur les victimes d'incendie.

On observe une tendance compréhensible chez ceux qui s'occupent de lieux d'incendie à se sentir dépassés par l'ampleur de la destruction sur ces lieux. Les enquêtes sur les incendies sont souvent complexes et difficiles à interpréter, et lorsque les pertes sont considérables il se peut que l'enquêteur se sente accablé, dans une impasse ou préoccupé et, par conséquent, n'arrive pas à prendre les mesures judicieuses nécessaires. Pour éviter de telles situations graves, il nous incombe d'élaborer une approche analytique et systématique de l'enquête sur les lieux de l'incendie.

Executive summary

Much of the current literature available to fire investigators focuses on fire suppression, fire investigations and methods. There is, however a paucity of information dedicated the identification and recovery of human remains in fatal fire settings, a vital component of the investigation process. It is noteworthy that, in recent years, the discipline of archaeology has been well documented in the recovery of antiquities and has been applied successfully to certain crime scenes.

It is the goal of this author to demonstrate that a similar application in fatal fire situations would be equally effective.

The aim of this study is to assist fire investigators in understanding the value of the application of archaeological recovery methods at fatal fire scenes. It also is intended to provide insight into the essential skills utilized in these methods. The anticipated outcome can be to increase the amount of human remains recovered along with more associated artifacts surrounding the death and, thereby, improve the quantity and quality of critical evidence. It is anticipated that this study will have a positive impact within the forensic community in the investigation of fire fatalities.

There is an understandable tendency for those involved in fire settings to become overwhelmed at the magnitude and destruction of the scene itself. Fire investigations are often complex and difficult to interpret, and, at fires where the loss is large, there is a potential problem that the investigator may become overpowered, fixated or pre-occupied, and, therefore, fail to take the necessary judicious steps. To avoid these serious situations, it is imperative to develop an analytical and systematic approach to scene investigation.

In placing a strong emphasis on the systematic approach to fire investigations, it is expected that fire investigators with experience and training in archaeological methods will successfully meet the rigorous test of the scientific method. A scientist observes the real world and draws conclusions from these observations. The observations are then tested to determine their validity. How, then, could archaeology or the application of archaeological methodologies assist the excavator at fatal fire scenes?

“ Archaeology concerns itself with learning the details of everyday life as well as significant or unique events, arranging these reconstructions in chronological sequences to create histories, attempting to understand or explain why things happened the way they did...” (R.M. Stewart, 2002:1).

Keeping this in mind, refined techniques of human remains recovery, the location of associated artifacts, and the observation of body positioning within the context of the structure and scene analysis will allow for a more accurate analysis to move toward proving this hypothesis. The primary objective of the study, as profiled in this thesis, is to employ and contrast the methods for recovery of human remains in a fire setting in order

to increase the contextual and associational data acquired to reconstruct the event more accurately.

Basically, this study involves a three-fold method: involving the use of “comparative” fires, the application of a questionnaire to over five hundred historical fatal fires within the Province of Ontario and fire excavations conducted in the everyday course of employment for this author.

The “comparative” fires involved existing standing structures, pre-prepared with pig cadavers and artifacts associated with homicide and allowing a total burn to take place.

Personnel who lacked formal training in the disciplines of archaeology and anthropology conducted the initial search for human remains. Any recovered remains and artifacts were photographed, mapped *in situ* and collected. A second search team, consisting of individuals experienced and trained in archaeological techniques and with a solid background in human osteology were then utilized. A proper archaeological-style grid search was undertaken with all/or any artifacts and human remains photographed, mapped and recorded.

The quantitative relationship between the items recovered by the two teams was profiled and documented. At this point, there have been four “comparative” fires conducted.

The historical portion of this study involves the application of an extensive questionnaire to over five hundred historical fires. The purpose of the questionnaire was to capture existing data, involving the methods employed by previous fire investigators at similar types of scenes, by way of scene comparison and rate of recovery.

The “day-to-day” scene data relates to actual fatal fire scenes excavated by this author. The data obtained, including the amount of human remains recovered and artifacts associated to the fatal fire scene excavated from the very beginning, are profiled in this method.

Sommaire

Une bonne partie de la documentation actuelle à la disposition des enquêteurs sur les incendies met l'accent sur l'extinction des feux, de même que les enquêtes et les méthodes relatives aux incendies. On manque toutefois d'information sur l'identification et la récupération des restes humains sur les lieux d'un incendie mortel, composante vitale du processus d'enquête. Il convient de noter qu'au cours des dernières années, la discipline de l'archéologie a été bien documentée en matière de récupération des antiquités et a pu s'appliquer avec succès à certaines scènes de crime.

Mon objectif est de démontrer qu'une application semblable dans les situations d'incendie mortel serait tout aussi efficace.

Cette étude a pour but d'aider les enquêteurs sur les incendies à comprendre la valeur de l'application de méthodes de récupération archéologique sur les lieux où un incendie mortel s'est produit. Elle vise aussi à mieux comprendre les compétences essentielles utilisées dans ces méthodes. On pourrait accroître la quantité de restes humains récupérés de même que celle des artefacts qui entourent la personne décédée et, par conséquent, améliorer la quantité et la qualité des preuves critiques. On s'attend à ce que cette étude ait des conséquences positives dans la communauté médico-légale en matière d'enquête sur les victimes d'incendie.

On observe une tendance compréhensible chez ceux qui s'occupent de lieux d'incendie à se sentir dépassés par l'ampleur de la destruction sur ces lieux. Les enquêtes sur les incendies sont souvent complexes et difficiles à interpréter, et lorsque les pertes sont considérables il se peut que l'enquêteur se sente accablé, dans une impasse ou préoccupé et, par conséquent, n'arrive pas à prendre les mesures judicieuses nécessaires. Pour éviter de telles situations graves, il nous incombe d'élaborer une approche analytique et systématique de l'enquête sur les lieux de l'incendie.

En mettant fortement l'accent sur l'approche systématique des enquêtes sur les incendies, on s'attend à ce que les enquêteurs possèdent une expérience des méthodes archéologiques, et une formation dans le domaine, et à ce qu'ils réussissent le test rigoureux de la méthode scientifique. Un scientifique observe le monde réel et en tire des conclusions. Ces dernières sont alors mises à l'épreuve pour en déterminer la validité. Comment, dès lors, l'archéologie ou l'application de méthodes archéologiques peut-elle aider les ouvriers à l'excavation sur les lieux d'un sinistre mortel?

« L'archéologie s'intéresse aux détails de la vie quotidienne de même qu'aux manifestations uniques ou significatives; elle aménage ces reconstructions selon un ordre chronologique pour créer des historiques, et chercher à comprendre ou à expliquer pourquoi les choses se sont produites de telle façon... » (R.M. Stewart, 2002, p. 1).

En gardant ces principes présents à l'esprit, des techniques fines de récupération des restes humains, la localisation d'artefacts connexes et l'observation de la position du corps dans le contexte de la structure et de l'analyse des lieux permettra une étude plus exacte en vue de prouver cette hypothèse. L'objectif principal de cette étude, comme le décrit cette thèse, est d'employer et de comparer les méthodes de récupération des restes

humains sur les lieux de l'incendie afin d'accroître les données associatives et contextuelles acquises en vue de reconstruire la situation plus précisément.

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1 Introduction

1.1 Nature and Importance of the problem

Problem:

Fire investigations are often complex and difficult to assess during the incipient stages of the process. The magnitude of the fire scene, where the loss is heavy may allow the investigator to become inundated with questions and thereby obscure the optimal path to follow. The fire investigation community acknowledges the potential for the fire investigator to become fixated or pre-occupied and consequently demands the application of an analytical and systematic approach to scene investigation. “This analytical approach recognizes the fact that to be a successful fire investigator, numerous facets of fires, fuels, people, and investigative procedures must be understood and mastered” (DeHaan 2002; 4-5)

Stepping beyond the origin, cause and circumstance investigation, the excavator must be conscious of possible criminal activity linked to the fire and be aware that the presents of associated artifacts may be overlooked and missed entirely during the recovery phase. This poses the question: will a fire investigator with a background and experience in archaeological methods be more effective in the recovery of human remains in a fatal fire setting?

Currently:

The Technical Committee in Fire Investigations section of the National Fire Protection Association (NFPA 921) was established to improve fire investigation processes and the quality of information on fires resulting from the investigative process. A considerable amount of literature exists concerning the excavation and the investigation of fire scenes including protocols from both law enforcement and fire services, these publications; however do not address the need for specialization and expertise in the area of fatal fire victim recoveries.

Moreover, it is also of paramount concern that excavators maximize the amount of human remains recovered in these settings. Determining if peri-mortem trauma was present and whether the fire was set intentionally to disguise a homicide is vital. The recovery of human bone bearing peri-mortem trauma will assist the coroner and pathologist in establishing the cause and manner of death. The Standard Operating Guidelines in the Office of the Fire Marshal for the Province of Ontario for instance, both supports and quotes the methods as promulgated by the NFPA 921 Guide for Fire and Explosion Investigations, 2008 Edition.

Solution:

What would be the ramifications if the essential signs of murder were missed in the excavation? What additional training and expertise would improve the qualifications of the excavators and provide them the “tools” to more efficiently locate, identify and recover human remains located within a fatal fire. The systematic and methodical processing of a fatal fire scene could make the difference between a classified fire fatality, or a fire which was used to conceal a homicide. Fire investigators with a solid background in fire scene recoveries, coupled with training in archaeological methods

would be more proficient in the area of human remains recovery and thereby maximize the amount of remains recovered.

Research Questions

The objectives of this research are to answer the following questions:

1. Are the current methods of human remains recovery in fatal fire settings adequate?
2. Does the training given to fire investigators address the issues of human remains recovery?
3. Will training and expertise in the area of human osteology and archaeological methods, quantitatively increase the amount of human remains and associated evidence/artifacts recovered by fire investigators?
4. Will this study identify the need for increased training and education for fire investigators?
5. What are the avenues for possible future research?

1.2 Proposed Methods

To address this issue, this paper has examined three main areas:

1. Historical fatal fires from the Office of the Fire Marshal for the Province of Ontario dating back to the year 2000.
2. Conduct search and recovery exercises of carefully prepared “comparative” fires, utilizing persons trained in archaeological methods and those lacking this expertise.
3. This author, an investigator with the Office of the Fire Marshal, will conduct fatal fire recoveries utilizing archaeological methods in work-related fatal fire scenes.

1.3 Aims and Objectives

1.3.1 Aims

The aim of this dissertation is to provide solid data to support the application of archaeological methods in fatal fire settings. Additionally, it will demonstrate that personnel trained in forensic archaeology and human osteology or the recognition of human bones will be better suited to locate, identify and recover human remains and associated artifacts in a fatal fire setting. The impact of an improperly

excavated fire scene may make the difference between a fire death or a homicide hidden by an intentionally set fire.

1.3.2 Objectives

This dissertation will achieve the following objectives:

- Provide supportive data which contrasts recovered remains and associated artifacts from personnel trained in archaeological recovery techniques and those who are not.
- Provide supporting data indicating that recovery methods utilized in the past need to be improved upon.
- Provide supporting data to prove that the persons trained and experienced in human Osteology and forensic archaeological methods will maximize the amount of human remains and associated artifacts recovered in a fatal fire setting.
- Critically assess the experimental results.

1.3.3 Why is it Important to Recover Human Remains in Fatal Fires?

The recovery of human remains in a fatal fire setting serves several purposes. Morally, to collect and transport a human body for burial is closure for the family, a role which society looks to the fire investigators to fulfill. The Coroner's Act for the Province of Ontario stipulates that in their legislated mandate, in cases involving human remains, the recovery and submission for cause and manner of death is necessary. Coupled with this, to maximize the amount of human remains recovered could significantly impact the determination of the cause and manner of death. To overlook a phalanx containing an obvious defensive wound would alter greatly the results of the cause and manner of death, especially if there are no other indicators of a violent death present. The inability to properly diagnose the cause and manner of death would allow a perpetrator to, literally, get away with murder.

This places an extremely important onus squarely on the shoulders of the fire investigator.

1.4 State of Current Knowledge

The Technical Committee in Fire Investigations section of the National Fire Protection Association (NFPA 921) was established to improve the fire investigation processes and the quality of information on fires resulting from the investigative process.

It addresses and strongly supports the application of the scientific method of fire investigation. It also asserts that the basic methodology of fire investigation should rely on the use of a systematic approach and attention to all relevant details.

The latest edition of the NFPA 921 Guide for Fire and Explosion Investigations, developed by the Technical Committee on Fire Investigations, was acted on by the

National Fire Protection Association in November 2003 and subsequently published on January 16, 2004. (Churchward et al 2008; 921 – 1)

The NFPA 921 describes the “scientific method” as “a principle of inquiry that forms a basis for legitimate scientific and engineering processes, including fire investigation.” (Churchward et.al 2008; 921-14) It defines the process of collection and interpretation of empirical data along with the resulting analytical steps taken by careful and professional recovery and investigative techniques.

With strong emphasis being placed on the systematic approach to fire investigations, it is expected that fire investigators with experience and training in archaeological methods will successfully meet and surpass the rigorous test of the scientific method.

Emphasizing these facts, the average fire investigator lacks formal training in the fields of archaeology, forensic anthropology and human osteology. It becomes obvious that creating an investigator with a strong background in fire investigations, enhanced with the above-listed disciplines would produce a unique “hybrid”, capable of significant changes in current recovery methods.

2 Methods and Materials

2.1 Archaeology

Archeology can be described as the study of the human past through the recovery and analysis of the remains of past civilizations. Archaeology provides an order to describe events which occurred in ancient times. Formerly, archeology was considered no more than a rich man's pursuit of interest, or conversely, grave robbing. Within the last fifty years, however with the introduction of a bona fide scientific methodology being introduced to the field of archeology, it has been recognized as a science. Science discovers facts about the natural world by observing either objects or events. A scientist observes the real world and draws conclusions from these observations. The observations are then tested to determine their validity. How, then, could archaeology or the application of archaeological methodologies assist the excavator at fatal fire scenes?

“ Archaeology concerns itself with learning the details of everyday life as well as significant or unique events, arranging these reconstructions in chronological sequences to create histories, attempting to understand or explain why things happened the way they did...” (R.M. Stewart 2002:1)

“To study the past, archaeologists define research questions and apply a series of archaeological methods by which they discover, recover, preserve, describe and analyze the archaeological record to answer those questions” (Sharen and Ashmore 2002: 14-15)

Archaeology, the study of past antiquities and societies, also has a modern application. To strip away years and address the study or the understanding of modern human behavioral patterns testifies to the uniqueness of this science.

2.2 Primary Objective

The primary objective of this particular study is to employ and contrast the methods of recovery of human remains in a fire setting, attempting to increase the contextual and associational data acquired in order to reconstruct the event more accurately. R. Michael Stewart addresses the term “context” and the three fundamental components of context as the “spatial, the chronological and the behavioral – the situation of archaeological evidence in space and time” (R.M. Stewart 2002; 2)

This research focuses on the recovery of human remains and associated artifacts in a fatal fire setting. It is being conducted to test the hypothesis that excavators without training and experience in archaeological field methodologies may have a negative influence on locating human remains and associated artifacts within a given scene. Will the application of archaeological methodologies, employed at fatal fire scenes, serve to increase the amount of human remains and associated artifacts recovered over scenes already processed by persons who lack training in the archaeological methods of search and recovery?

The research conducted in this study will, in all likelihood, provide a definite correlation to the Comprehensive Fire Safety Effectiveness Model of the Office of the Fire Marshal for the Province of Ontario. The study of human activity prior to a fire and during a fire is of much interest to the Office of the Fire Marshal. Where merited, the employment of

archaeological methodologies in those fatal fire scene examinations may enhance our knowledge of such activities so that they will contribute to future public fire safety initiatives by the Office of the Fire Marshal, thus reducing the loss of life and property due to fire. Eight key factors have been identified which affect fire losses in Ontario. Together, these factors have been conceptualized into the Comprehensive Model. The completed model will serve as a basis for an objective evaluation of [fire protection services](#) in a municipality. Application of the model provides an opportunity to maximize the effectiveness of the fire protection services while ensuring an appropriate level of health and safety for the fire fighters. Each of the eight factors will, in reality contribute differently to the total level of protection provided to a community, and as such, interacts with the role of the fire investigator in fatal fire recoveries.

To fully understand how an individual responded to surrounding stimuli at the time of a fire will hopefully lead to an enhanced understanding of human activities that result in fire deaths. The identification and understanding of these behavioral patterns might provide an important window, clarifying further lessons learned from past fire fatalities. Opening this window into past human behavioral patterns could prove crucial towards understanding the application of suppression practices, response, scene preservation, recovery techniques for both pre and post-fire. It would also be beneficial to address Fire Prevention Programs to enhance public and personal safety. “Field recoveries of forensic evidence are most effective and efficient when contemporary archaeological recovery methods and interpretations are utilized” (Dirkmaat and Adavasio 1997; 452)

In fire settings, there is a natural tendency for those involved to become overwhelmed at the magnitude and destruction of the scene itself. The core of the fatal fire investigation is two-fold both in the initial stages and as the investigation progresses:

- The location of human remains and associated artifacts
- The fire cause rather than extent

One can easily become inundated at fires where there is large loss and to take in the immense scene will obscure the path the investigator must take. Fire investigations are often complex and difficult to during the incipient stages of the process. The fire investigation community recognizes the potential for the fire investigator to become fixated or pre-occupied, and requires the application of an analytical and systematic approach to scene investigation. “This analytical approach recognizes the fact that to be a successful fire investigator, numerous facets of fires, fuels, people, and investigative procedures must be understood and mastered” (DeHaan 2008; 4-5)

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With strong emphasis being placed on the systematic approach to fire investigations, it is expected that fire investigators with experience and training in archaeological methods will successfully meet the rigorous test of the scientific method.

Keeping this in mind, refined techniques of human remains recovery, the location of associated artifacts, and the observation of body positioning within the context of the structure and scene analysis will allow for more accurate analysis to proving this hypothesis.

This is a direct study with events being documented prior to, during and after the search and recovery portion has been completed. It also ensures that the results are not viewed as anecdotal and may, in fact, be indicative of large scale applications to fatal fire scenes.

The study, as such, takes into consideration a number of variables i.e. structure size and number of levels, amount of fire consumption, building destruction, climatologic conditions, proximity of attending fire service, training and expertise of fire excavators and number of excavators involved, to name a few.

It also explores contexts in which human remains in fatal fire settings may be present or have been present and it is proposed, will be accomplished by the implementation of three phases.

2.3 The Three Phases of This Research Study

The first phase (actualistic phase) involved attending current Office of the Fire Marshal related fatal fire scenes in which little of the actual scene is controlled. Phase one involves fire fatalities with the implementation of an archaeological-style grid search and related methodologies in the initial search and recovery portion of this phase.

This phase included the careful collection and photographing (including video graphing) of the scene along with the qualitative and quantitative documentation of empirical data and scene information. Both the static and dynamic aspect of a field context was observed involving actual fatal fire scenes.

The second phase (comparative phase) involved conducting carefully controlled fire scene comparison recoveries by employing a near natural context using human analogues, (in this project, pig carcasses) and known artifacts excavated by persons who lack training in archaeological recovery methods. This portion of the study involved the utilization students currently involved in fire fighting training, training of a comparable nature or current serving fire fighters. These individuals excavated a “prepared” comparative scene looking for remains and artifacts. The second crew in to search, persons trained in archaeological techniques would then re-excavated the structure. This phase included the direct application of careful collection and documentation methods of empirical and scene data.

This portion of the study incorporated observations on carcasses and associated artifacts of known deposition and exact placement within the structure. The ideology behind the application of the grid or quadrant style of search would demonstrate that any level may be excavated in this manner to enhance the contextual control over the location of human remains and artifacts. The careful scene re-construction during the debris removal, or de-layering, the mapping and photographing of remains/artifacts in their recovery position and their context within the scene will demonstrate the exact provenience of the recovered items of interest.

“Analysis and recognition of debris overlies the victim. This debris is usually deposited in a predictable manner: from upper levels to lower levels, primarily in a horizontal orientation, and in a series of layers (strata) reflecting sequential emplacement events that mirror the original vertical relationships of the structure itself.” (Dirkmaat 2002:458)

“Arbitrary levels are levels whose thickness has been decided subjectively, but with purpose in mind: used to maintain tighter control on the provenience of any finds or data collected during an excavation....an arbitrary level is generally thin”. (M. Stewart 2003; 249)

The Third Phase (historical phase), involves the application of an extensive questionnaire to historical fatal fires in which investigators from the Office of the Fire Marshal for the Province of Ontario, Canada have been involved. The data set includes fires from the years 2000 to 2007 inclusive. The intent of this phase is to examine the variables encountered by fire investigators for the past seven years. The questionnaire addresses such variables as the experience of the investigator, proximity of the fire scene to the responding fire station, the physical construction of the structures involved, the number and location of deceased within the scene itself along with their condition and inventory. These are several of the areas addressed by this questionnaire, however, the main thrust of applying this questionnaire was to identify and quantify the total amount of human remains which were identified and recovered.

2.4 Comparative Phase and Stages

The second phase or the “comparative phase”, is broken down further into two separate but distinct stages:

2.4.1 Comparative Scenes

Comparative Fire Scenes:

In order for this thesis to be objective and complete in its totality, comparative fires involving structures and subsequent processing by untrained personnel was essential. As with scenes involving current work-related fires, to process a greater number of comparative fires would have been ideal.

Having said this, with the mounting concern over ecological and environmental issues with fires involving entire structures, the possibility of a high number count for comparative fires was not possible.

The target for comparative fires over an eight to ten month period was no less than four with a maximum of eight. There were four comparative fires processed in this study.

It should also be pointed out that there was available data involving Mercyhurst students, trained in archaeological methods, conducting crime scene searches successfully utilizing these techniques, once law enforcement personnel had concluded their initial search. Needless to say, in essence the methodology is similar in design with individuals conducting the initial search lacking the training in archaeological search methodologies. The secondary search conducted by persons with the essential archaeological training and experience yielded human remains and/or associated artifacts missed in the initial search. For the purposes of this paper, this data would be applicable and would complement the overall empirical data collected.

2.4.2 What is the intent of conducting scene comparisons?

The intent of conducting fire scene comparisons was to collect data to prove or disprove the hypothesis: being addressed in this study and involves the utilization of carefully orchestrated “controls”. As stated above, in this study, the scene comparisons are categorized by two **stages**:

Stage One:

Prepare a simulated fire scene by using an unbiased third party, someone with no vested interest in this study. This would entail the placement of deceased pigs into a wooden structure along with associated artifacts.

Have the independent party photograph and record the location of the pigs and artifacts prior to having the structure set on fire by fire service personnel.

Have recovery personnel with little or no forensic or archaeological background; excavate the comparison fire scene upon fire suppression without the utilization of the grid or quadrant-type search or the utilization of archaeological techniques.

Upon completion of the search, document the recovered human remains and associated artifacts *in situ* which had been located within this initial section. Photograph the area of search. Remove, inventory and document recovered remains and associated artifacts recovered from the scene.

Stage Two:

- Assemble a grid over the second identical scene from a set datum point and establish a baseline.
- Number and label each grid square. Photograph and video graph the overall scene.
- Commence the excavation of each grid square by the use of archaeological methods; i.e. the careful de-layering of remaining debris.
- Map, measure and photograph recovered remains and associated artifacts *in situ*.
- Complete the scene in exactly the same manner.

- Conduct overall photographs of the scene prior to the removal of the grid and the recovery of remains and artifacts.
- Complete an inventory of recovered remains and artifacts.
- Photograph completed inventory.
- Document findings.

2.4.3 The Grid

The grid-system is basically a series of parallel lines which run off of a baseline with the inclusion of additional lines running at right angles. “Grids are used in controlled surface collections of archaeological sites, as a way of subdividing for the purposes of sampling, as a way of organizing the spatial distribution of excavation units.....they are a basic way of subdividing space, controlling and documenting the context of things within that space” (Stewart, M. 2003: 144)

The uniqueness of implementing the grid-search not only addresses the systematic method of search but is a variable which may be considered size dependant and adaptable to any scene.

In the utilization of this method of search, the following steps would be applied:

- Establish a datum
- Establish a baseline
- Construct the grid over the scene using an appropriate sized grid
- Number each of the grid squares
- Draw an overall site-plan including the grid
- Photograph and video graph the overall scene and grid

2.5 Number of Anticipated Scenes

Work Related Fire Scenes:

The number of fatal fire scenes attended through the Office of the Fire Marshal was variable. With a base target period of eight to ten months, it was originally anticipated that the author would attend a minimum of eight to ten fire scenes which fit this criterion. The author attended six such scenes.

Historical Fire Scenes:

The documentation anticipated by this author involved some five-hundred and sixty fires dating back to the beginning of the year 2000. The historical files are kept in two central Regional Offices of the Office of the Fire Marshal. Due to on going civil actions and the distance between the offices, this author was able to document less than one-half of these files.

Comparative Fire Scenes:

With the time allotted to this study, this author was able to locate and utilize four comparative fires. There were a number of variables involved in the logistics of these fires from start to finish. These include: locating of appropriate structures, the location of these structures, the securing of evidence to be utilized in the study, the preparation of these structures, arrange for both search “crews” to be in place at the times required for their respective portions of the search.

Phase 3 - Historical Data:

The Office of the Fire Marshal for the Province of Ontario is mandated to investigate, amongst other fire related incidents, all fatal fires within the Province. The information and data collected from a certain number of these scenes was, to a degree, available to the writer for the purposes of gathering information and applicable data. The files and associated documentation of previously excavated fatal fires scenes within the Province of Ontario, in theory, would prove invaluable to this study and would be considered a major informational and beneficial source.

The information obtained from the careful gleaning of these records was subject to strict guidelines under the Freedom of Information and Protection of Privacy Act (FIPPA) and was handled with the utmost respect and integrity. All references to any of these reports avoided the identification of the specific circumstances that may indicate specifics which may compromise an investigation or any personal information as described in the aforementioned legislation. A uniform seven page questionnaire was applied to these historical fires in order to quantify the results from each file and is identical to the questionnaire which was applied to the working fires.

3 Fatal Fire Investigation

3.1 Fire Recoveries

This author attended a number of work-related fatal fire scenes both involving structures and vehicles over the course of this study, a percentage fit the criterion as previously listed. There were examples of fatal fire scenes where the author was able to attend and to assist the lead investigator from the Office of the Fire Marshal in the recovery of human remains in a fatal structure fire and one involving a vehicle;

3.1.1 Scene 1 Structure Fire

The fire scene was located in the outskirts of a large Ontario city. The building consisted of a one story home where the entire structure was lost with substantial debris located in the basement of the home.

There were four deceased inside the structure in total. Person #1 which had been located on the front lawn was removed prior to the processing of the scene.

There was extensive debris created from a gaseous explosion. Preliminary information indicated that Person #1 killed Persons 2 to 5 and set fire to the home by the use of a volatile, ignitable liquid.

Person #2 was located in the basement area on top of the main debris but still hidden within the ceiling and roof debris. Person #2 was located by the first recovery crew prior to my arrival. This individual was initially placed on the main floor prior to the fire and consequently fell through into the basement with the collapse of the main floor.

The second individual to be located in the debris was Person #3 who was located in the northwest corner of the basement. Person#3 was situated on the remains of a mattress with total flash over having taken place in the one area of origin. The fire debris situated on top of and underneath the deceased was indicative of Person #3 being in the main floor bedroom prior to the fire. The deceased fell into the basement during the collapse of the main floor. The third deceased Person #4 was located the following day approximately five to six feet from Person #2. This individual was under approximately 3.5 to 4.0 feet of fire debris and was situated on top of the wooden basement sub-floor.

Even with the use of a cadaver dog, the final deceased eluded the search team. Due to the large amount of fire debris and the urgency in locating and removing the final victim, a mechanical back-hoe was brought in to assist. The use of “string” to indicate the grids was therefore of no use due to complications with the system of debris removal.

Once the appropriate fire debris samples were collected, a systematic grid system was placed over top of the fire debris with the use of measuring tapes and fluorescent paint. The systematic removal of fire debris from the first grid was commenced by a mechanical back-hoe beginning with the southeast corner of the basement.

The debris in this initial square was removed in 6 inch increments and taken to several inches above the wooden basement sub-floor.

The second grid excavated was the grid directly north of the first grid searched. The fifth and final victim, Person #5 was located approximately 1.5 to 2.0 feet from the surface on the wooden sub-floor.

The Person #5 displayed signs of more severe fire trauma than the previous four victims and was basically “melded” to the wooden flooring.

The mid-section, pelvis and right femur suffered fire trauma and fragmenting. Recovery posed a problem. The method agreed to and utilized was to remove the deceased, flooring and all. An electric saw was used to cut through the plywood and several 2 inch by 4 inch boards located below and placed into a body bag for removal.

The remaining grid squares were excavated in a similar fashion with fire debris associated to body position removed and screened for evidence and human remains.

The implementation of the grid-style search and the subsequent careful excavation of this scene yielded the recovery of the deceased involved in this fire along with the recovery of crucial evidence associated to the perpetration of the crime of homicide.



Figure 1-Ariel photo indicating the amount of destruction in the explosion and fire

The excavators in this scene were aware that a firearm had been used in the quadruple homicide. However, even though the actual weapon had been discovered initially, the only link was a spent .22 calibre casing found in the clothing of the youngest deceased. The systematic and methodological search employed at this scene assisted the investigators in locating the deceased within the grid and, with careful excavation around the deceased, located the casing.



Figure 2 - Spent .22 calibre casing located next to the body of the youngest deceased.

3.1.2 Scene 2 Vehicle Fire

The work related fires encountered by this author included fatal fires involving vehicles as well as structure fires. The vehicle fire being illustrated in this study thesis, involves the homicide of a four year old female, a 22 year old female and a 44 year old female. The deceased were placed inside a passenger van and set on fire. Following fire suppression, this author excavated the vehicle using archaeological techniques by instituting an internal grid system within the vehicle and removing the debris top-down. The four year old had been located along the rear portion of the interior along a bench seat prior to the fire. The excavation and screening of the fire debris below the remnants of this seat yielded several crowns, remnants of deciduous teeth. The resulting analysis by the forensic odontologist was able to place the deceased in an age range consistent with the missing four year old female.

Also, the systematic and methodological search conducted within the van interior yielded a firearm, firearm shell casings along with a near complete inventory of human remains.



Figure 3 - Passenger van containing the bodies of three individuals



Figure 4 - Vehicle interior displaying two co-mingled adults in the centre area and a child along the rear bench.



Figure 5 - Weapon recovered in the front passenger section of vehicle.

3.2 Comparative Structure Fires

The comparative structure fires began with problems related to the type of structure, having been being composed of heavy timber, issues of further fire suppression before the first crew could enter and the fact that there were limited personnel for both crews. The time-lines set out were not realistic for the type of structure and the personnel available for both search crews and were inadequate. In all, this study conducted four successful comparative fires; the following is an example of one such fire.

COMPARATIVE STRUCTURE FIRE #1

OBJECTIVE: To determine what evidence/remains students, with both education and experience in the fields of archaeology and osteology, can locate with the use of a proper grid-style search in a fire ravaged structure as compared to a search conducted by persons with a fire fighting background.

DATE: 23-25 November 2007

DESCRIPTION:

- Single-story wood frame farmhouse – 100 to 110 years old.
- Pitched roof with asphalt shingles

ARTIFACTS:

1. 2 pig cadavers – 60 to 70 lbs.
2. 20 pig limbs of various sizes (with stainless steel tags)
3. 2 rifles
4. 1 rifle bolt
5. 3 shotgun shells (red)
6. 6 handgun shells
7. 12 2' x 2' carpet sections (with stainless steel tags)

SUMMARY:

This wood frame farm house was “prepared” on 23 November 2007 with the above noted artifacts which included, firearms, shell casings, 20 pig limbs and 2 pig cadavers were placed indiscriminately throughout the main floor and corresponding rooms. The artifacts were photographed in place while the structure was “wired” with thermocouples.

Personnel from the Chemistry Section of the Centre of Forensic Sciences, Toronto, placed 12 2' x 2' pieces of carpet containing samples of alcohol. Each carpet sample was tagged with a stainless steel tag.

On 24 November 2007, the fire control officer with the fire department poured a quantity of gasoline inside the main structure and caused it to be set on fire by the external application of a common road flare. The initial reaction of fire to gasoline caused a predictable “push” inside the structure with the thermocouples registering an immediate 600° Celsius increase within the interior temperatures.

The structure grew from the incipient stage into a fully working structure fire within fifteen minutes. The building was allowed to totally burn to the ground before some measure of suppression was applied. The total time of the burn was slightly in excess of one hour. On 25 November 2007, a crew of volunteer fire fighters commenced a pedestrian search of the structure remnants with a pre-search briefing which involved a homicide scenario. All or any artifacts/remains were then flagged and the search was concluded.

Following this initial primary search by the fire crew, 13 fourth year archaeology students from an area university commenced setting up an archaeological style grid over the fire debris by the utilization of tape measures, chaining pins and colored string. The artifacts located initially by the fire crews were measured, mapped and removed. Once this was done, the students, who also have an osteological background, commenced the scene excavation, GRID by GRID and the debris processed through a ¼ “screen.

All artifacts/remains located by the students were also measured, mapped and removed from the areas where they were located. Once the secondary search was completed, the artifacts/remains located by both search teams were compared and documented.

RESULTS:

FIRST CREW

- 7 Pig limbs/tags
- 1 – Shotgun shell
- 2 – Rifle barrels
- 12 – Pig limbs
- 7 – Steel tags/ carpet samples
- 3 – Handgun casings

SECOND CREW

- 1 – Rifle bolt

NOTE: the handgun casings and shotgun shell were found during the screening ccess, along with two pig limbs the remainder were found *in situ*. The carpet sections were totally destroyed in the fire leaving the stainless steel tags.

NOTE: The students were available for one eight hour day, should they have been available to return the following day, the excavation yield would have been higher.



Figure 6 - 100 year old farmhouse. One of the structures involved in this study as a comparative structure.

3.2.1 Thermocouple Reading

During the course of this structure fire, there were six thermocouples placed throughout the structure at various heights, four of which were associated to the pig cadavers both on top and underneath. The data logger unit, situated a short distance from the fire recorded the internal structure temperatures in ten second intervals. With the utilization of an

accelerant, the temperature immediately climbed from 4° Celsius to 577° Celsius in 10 seconds before dropping to a predictable level to just below 200° Celsius in just a few moments. The internal structure temperatures continued at this level for approximately eighteen minutes where there were visible upward spikes, although slight, they continued to rise while the fuel load within the structure reached ignition temperatures and became fully involved.

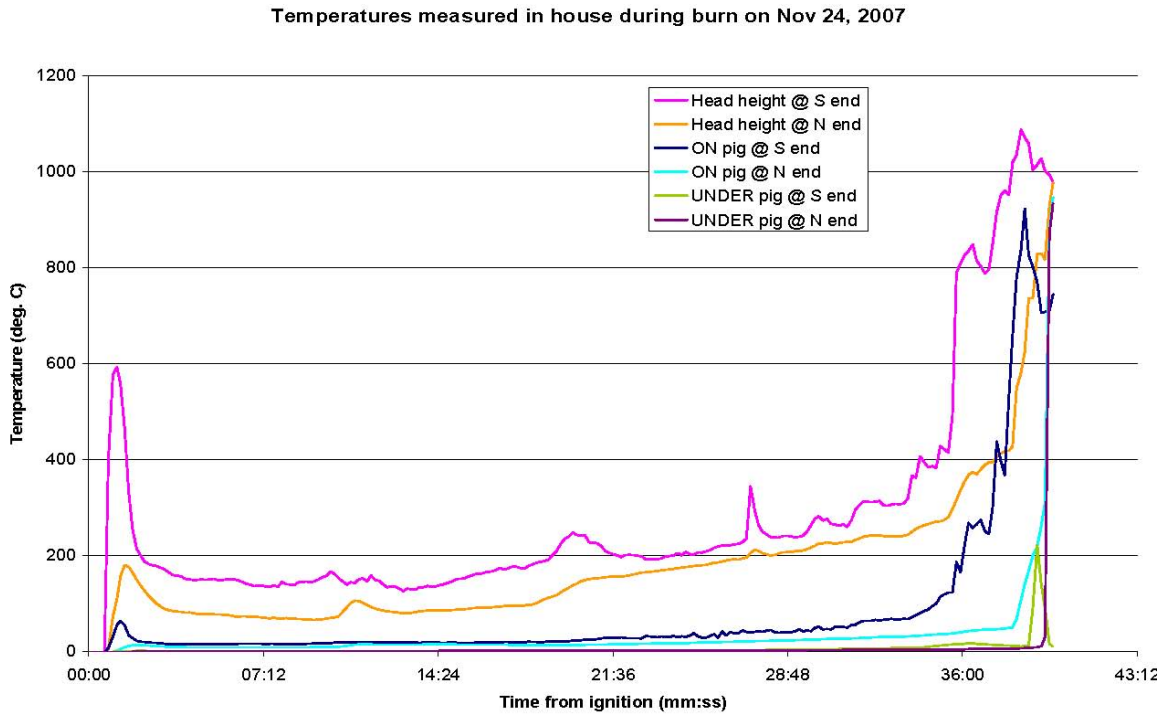


Figure 7- Temperatures measured in house during Nov. 24, 2007



Figure 8 - A pig limb, one of twenty used in this comparative fire.

Interestingly enough, the thermocouples placed under the pig cadavers remained at a constant low temperature throughout the fire until approximately the forty minute mark, where the internal structure temperatures reached in excess of 1100° Celsius and the thermocouples became compromised with heat and fire impingement.

The number of thermocouples utilized in this study could have been increased by adding them internally to the pig cadavers as well underneath and to also include in the estimation of the author, reflected accurately the temperature ranges and fluctuations in these types of fires. The variables with relation to fuel load within each comparative structure were story dwellings.

The majority of the structures utilized in this study were over one hundred years old, were of wood frame construction and were sided with a combination of wood, vinyl or aluminum siding. One of the problems identified, was the type of interior construction. The older homes, in many cases, were made of heavy timber construction and posed a problem with the time lines set out for the total burn of the dwelling and the times when the search crews could enter.

The time lines involving the search crews could have been extended by one day to facilitate the completion of the search. In two fires, the second crew in would have undoubtedly increased the already impressive amount of recovered remains and associated items. Having said this, the recovery, with the time allotted, was considerable.

4 Historical fires

4.1 Historical Fire Description

The total number of fatal fires attended by investigators with the Office of the Fire Marshal for the province of Ontario between the years 2000 and 2007 totaled over 560 fires. The questionnaire developed was an attempt to glean the maximum amount of historical data from these fatal fire files. The ideology behind this questionnaire was to compare and contrast the methods used by these individual investigators to recover fatal fire victims and all or any artifacts associated to them.

A number of the earlier fires in the years 2000 and 2001 were incomplete in their make-up, missing or incomplete investigator notes, photographs and Pathology reports. It was difficult, if not impossible to ascertain the total amount of remains recovered in the scene excavation on a case by case basis. There were neither notes addressing this aspect of the recovery nor were there photographs substantiating the completeness of the deceased persons.

There were two fatal fire occurrence files viewed by this author that indicated the scene excavators had taken a one week course in the Recovery of Human remains several months prior to attending these fires. The scene was processed using the archaeological methods taught to the investigators. In reviewing the notes and photographs of both scenes it was determined that both scenes had been processed using archaeological methods. In the field notes and subsequent photographs, along with the main torso, were descriptions and photographs of bone fragments and recovered teeth.

Also absent from these files, was a comprehensive Pathology report containing a body inventory. It was clear from the scene photographs in many files that the involved deceased persons had suffered thermal amputations in the fire, but there was no inventory indicating what was missing and what was had been recovered.

5 Conclusion:

The purpose of this study was to explore the possibility that the simple application of archaeological methodologies in scenes which involve fire fatalities would yield a higher return on the recovery of human remains and the artifacts associated to them. The National Fire Protection Association is a strong exponent of the scientific method of scene examination and identifies fire investigations as complex endeavors involving skill, technology, knowledge and science. In essence, the scientific method involves the gathering of data, the analysis of the collected data by inductive reasoning, the formulation of a hypothesis and the subsequent testing of this hypothesis by deductive reasoning. The careful collection of associational data and human remains in the context of a fatal fire scene is paramount.

The main objective of this study was, therefore, to apply archaeological methods to bona fide fatal fire scenes and scenes of a comparative nature. It has documented scenes in their entirety, and gathered all pertinent empirical and contextual data to compare and contrast the utilization of the stated methodology by trained and untrained persons.

Along with the application of methodological principles, archives of prior fatal fire scenes excavated by members of the Office of the Fire Marshal has provided a greater insight by way of contributing contextual and comparative data to the conclusions of this paper. It is also evident, that this study also addressed important human behavioral patterns of individuals situated in fatal fire scenes that are tangible and applicable to important public safety issues presented in the Comprehensive Fire Safety Effectiveness Model and the “scientific method” encompassed by the National Fire Protection Association. This will form the basis of a further paper on human behavioral patterns in fatal fires. Will the application of an archaeological-style search methodology contribute to greater successes in the recovery of deceased individuals and artifacts associated to them in fatal fire scenes? This thesis has proven so.

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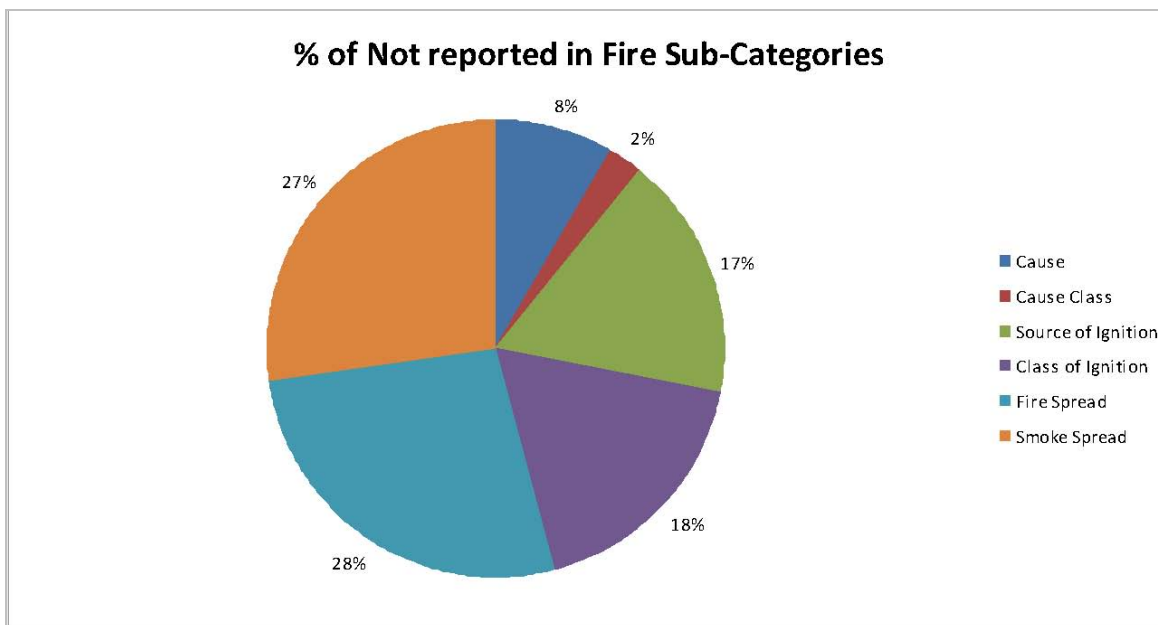
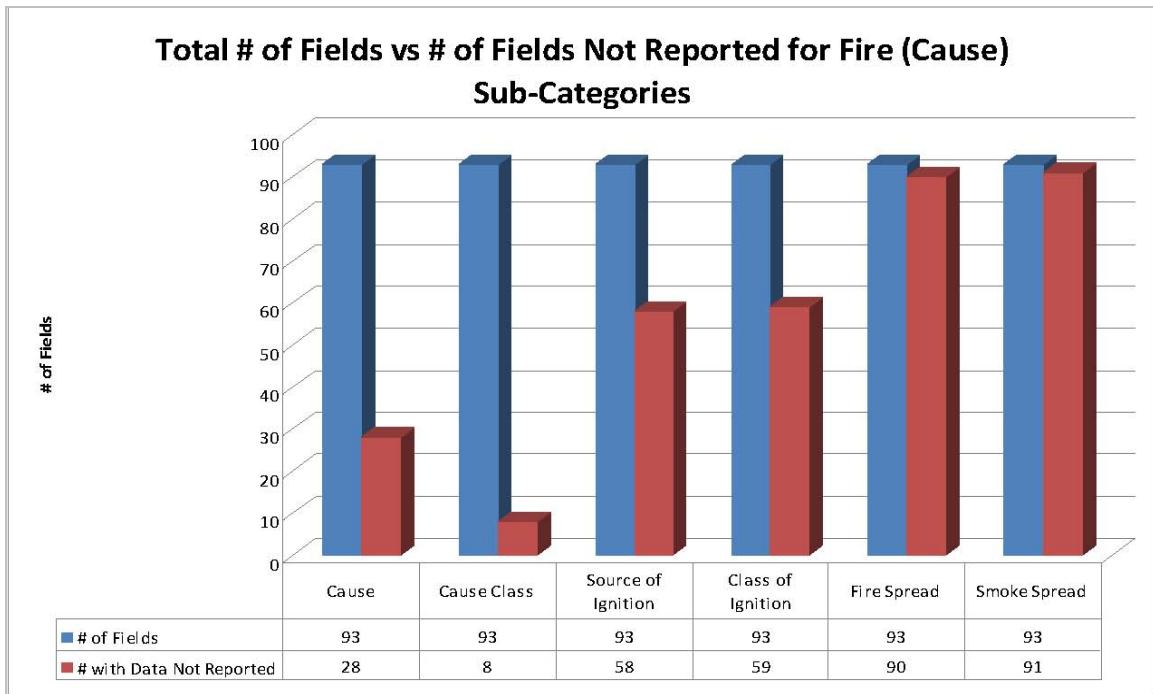
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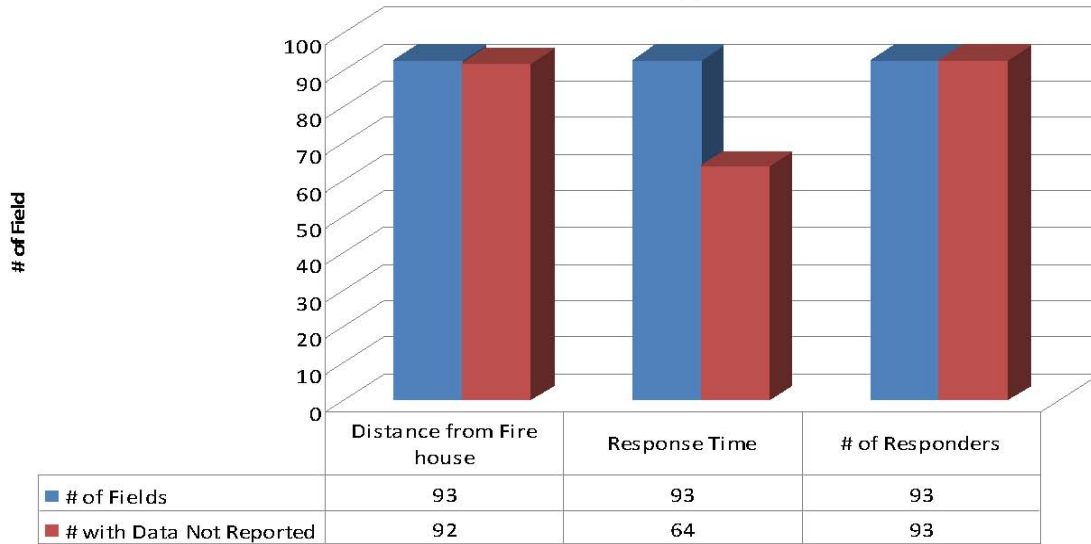
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Annex A Tables: Fire Cause Reporting

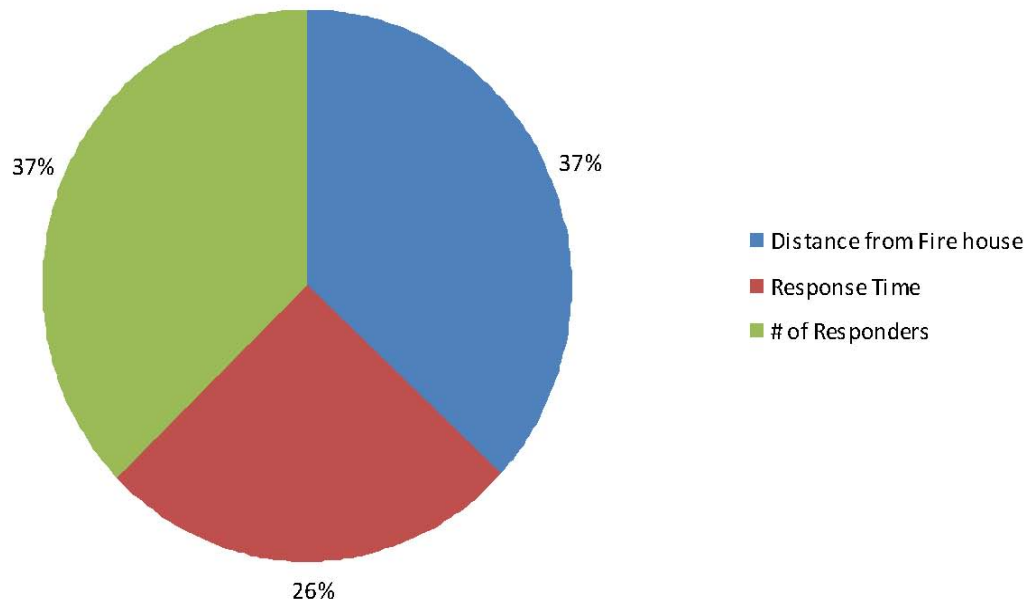


Annex B Tables: Responder Reporting

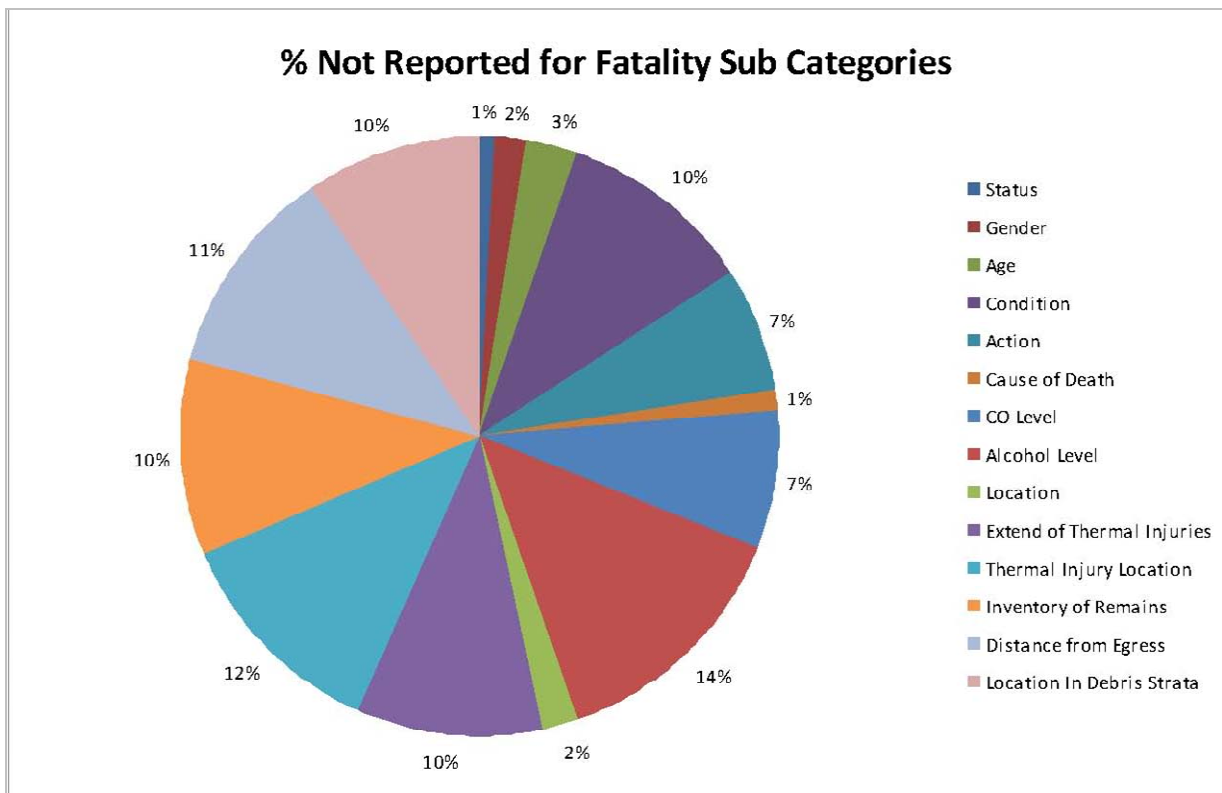
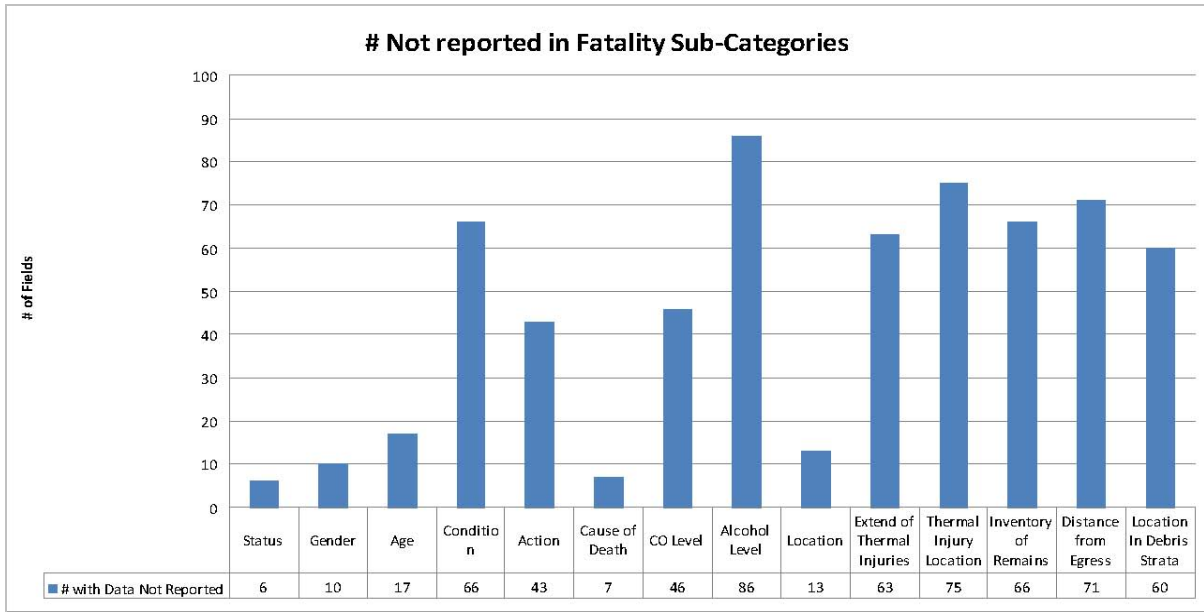
Total # of Fields vs # of Fields Not Reported in Responder Sub-Categories



% Not Reported in Responder Category



Annex C Tables: Fatality Reporting



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<p>3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)</p> <p style="text-align: center;">Recovery of human remains in a fatal fire setting using archaeological methods:</p>		
<p>4. AUTHORS (last name, followed by initials – ranks, titles, etc. not to be used)</p> <p style="text-align: center;">Olson, Gregory</p>		
<p>5. DATE OF PUBLICATION (Month and year of publication of document.)</p>	<p>6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)</p> <p style="text-align: center;">39</p>	<p>6b. NO. OF REFS (Total cited in document.)</p> <p style="text-align: center;">22</p>
<p>7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)</p> <p style="text-align: center;">Contract Report</p>		
<p>8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)</p> <p style="text-align: center;">Centre for Security Science (CRTI/PSTP) Defence R&D Canada 222 Nepean St. 11th Floor Ottawa, ON Canada K1A 0K2</p>		
<p>9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)</p>	<p>9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)</p> <p style="text-align: center;">CPRC 655961</p>	
<p>10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)</p> <p style="text-align: center;">DRDC CSS CR 2009-03</p>	<p>10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)</p>	
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The aim of this study is to assist fire investigators in understanding the value of the application of archaeological recovery methods at fatal fire scenes. It also is intended to provide insight into the essential skills utilized in these methods. The anticipated outcome can be to increase the amount of human remains recovered along with more associated artifacts surrounding the death and, thereby, improve the quantity and quality of critical evidence. It is anticipated that this study will have a positive impact within the forensic community in the investigation of fire fatalities.

There is an understandable tendency for those involved in fire settings to become overwhelmed at the magnitude and destruction of the scene itself. Fire investigations are often complex and difficult to interpret, and, at fires where the loss is large, there is a potential problem that the investigator may become overpowered, fixated or pre-occupied, and, therefore, fail to take the necessary judicious steps. To avoid these serious situations, it is imperative to develop an analytical and systematic approach to scene investigation.

Cette étude a pour but d'aider les enquêteurs sur les incendies à comprendre la valeur de l'application de méthodes de récupération archéologique sur les lieux où un incendie mortel s'est produit. Elle vise aussi à mieux comprendre les compétences essentielles utilisées dans ces méthodes. On pourrait accroître la quantité de restes humains récupérés de même que celle des artefacts qui entourent la personne décédée et, par conséquent, améliorer la quantité et la qualité des preuves critiques. On s'attend à ce que cette étude ait des conséquences positives dans la communauté médico-légale en matière d'enquête sur les victimes d'incendie.

On observe une tendance compréhensible chez ceux qui s'occupent de lieux d'incendie à se sentir dépassés par l'ampleur de la destruction sur ces lieux. Les enquêtes sur les incendies sont souvent complexes et difficiles à interpréter, et lorsque les pertes sont considérables il se peut que l'enquêteur se sente accablé, dans une impasse ou préoccupé et, par conséquent, n'arrive pas à prendre les mesures judicieuses nécessaires. Pour éviter de telles situations graves, il nous incombe d'élaborer une approche analytique et systématique de l'enquête sur les lieux de l'incendie.

14. **KEYWORDS, DESCRIPTORS or IDENTIFIERS** (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Fire, Fatality, Arson, Fire Investigation, Criminal Investigation, Human Remains, Archaeological Methods