



**WPI**



# **An Analysis of Hoarding and Squalor Incidents in Victoria, Australia**

Faculty Sequence Number: JS8 1506

An Interactive Qualifying Project to be submitted to the Faculty of  
Worcester Polytechnic Institute in partial fulfilment of the  
requirements for the degree of Bachelor of Science

Submitted by:

Jaclyn Bouvier  
Francisco Kang  
Raeshawn Kennedy  
Dimitrios Savva

Submitted to:

Project Advisors:

Professor Jeanine Skorinko, Worcester Polytechnic Institute  
Professor Reinhold Ludwig, Worcester Polytechnic Institute

Project Liaisons:

Julie Harris, Manager At Risk Groups Metropolitan Fire and Emergency Services  
Board

Assistant Chief Fire Officer Rob Purcell, Metropolitan Fire and Emergency Services  
Board

**May 5, 2015**

[mfb-d15@wpi.edu](mailto:mfb-d15@wpi.edu)

This report represents the work of WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its website without editorial or peer review. For more information about the projects program at WPI, please see <http://www.wpi.edu/academics/ugradstudies/project-learning.html>

**Abstract**

This study provides an analysis of all hoarding and squalor incidents reported by the Metropolitan Fire and Emergency Services Board and the Country Fire Authority from 3 April 2012 to 3 April 2015. We uncovered common characteristics of affected individuals, trends in risk indicators, and explored the fire dynamics of hoarding situations. The results of this study aim to increase operational knowledge of MFB and CFA firefighters when responding to incidents associated with hoarding and squalor.

## **Acknowledgements**

### ***MFB***

We would like to acknowledge and extend our gratitude to all individuals who helped us over the course of this project. Foremost, we would like to thank our sponsor Julie Harris, Manager at Risk Groups Community Resilience. Her expertise on this subject served as an invaluable resource throughout the course of our research. She worked closely with us over a two month timespan to ensure the success of this project. Next, we extend our thanks to Assistant Chief Fire Officer Rob Purcell, Director of Community Resilience and At Risk Groups team members Acting Station Officer Nick Petersen and Station Officer Danny Gunn. Also Tass Georgas Manager Structural Fire Safety for his guidance in exploring the fire dynamics of hoarding structure fires and the Fire Investigation and Analysis team.

### ***CFA***

We also thank Gwynne Brennan, Manager Community Resilience (CFA). She provided insight on the structure and dynamics of the organization and the department's previous work in relation to hoarding and squalor. We would also like to express our gratitude to CFA Station Officer Greg Abramovitch, who was involved in the early planning of this study. Greg was also the CFA operational liaison for the collection of incidents and spent several days showing us around the CFA near Geelong and organised interviews with CFA personnel in the region. Lastly we would like to thank Kate Waterman, Qualified Firefighter Rowan Taylor and the Fire Investigation team at CFA.

### ***WPI***

Finally, we would like to thank our project advisors, Professors Jeanine Skorinko and Reinhold Ludwig, whose feedback and advice provided us guidance and direction since the beginning of this project.

## Table of Figures

Figure 1	Clutter Image Rating Scale
Figure 2	Metropolitan District Map
Figure 3	Map of CFA Region
Figure 4	Empty CFAST Structure
Figure 5	Hoarding and/or Squalor Related Incidents Within the Metropolitan District
Figure 6	Distribution of Incident Type of Hoarding and/or Squalor Related Incidents - MFB
Figure 7	Age Distribution of All Hoarding and/or Squalor Related Incidents - MFB
Figure 8	Property Types of All Hoarding and/or Squalor Related Residence - MFB
Figure 9	Property Tenure of Hoarding and/or Squalor Related Residence - MFB
Figure 10	Causes of Hoarding Related Fires - MFB
Figure 11	Area of Origin for Hoarding Related Fires - MFB
Figure 12	Containment of Hoarding Related Fires - MFB
Figure 13	Presence of Smoke Alarms in Hoarding Residence - MFB
Figure 14	Number of Personnel Attending Hoarding Related Fires - MFB
Figure 15	Distribution of CFA Hoarding and Squalor Incidents
Figure 16	Distribution of Incident Type of Hoarding and/or Squalor Related Incidents - CFA
Figure 17	Causes of Hoarding Related Fires - CFA
Figure 18	Area of Origin for Hoarding Related Fires - CFA
Figure 19	Containment of Hoarding Related Fires - CFA
Figure 20	Presence of Smoke Alarms in Hoarding Residence
Figure 21	Living Room Upper Gas Layer Temperature
Figure 22	Kitchen Upper Gas Layer Temperature

## **Table of Tables**

Table 1	Sample Key Words
Table 2	Comparison of Incident Rates
Table 3	Yearly Incident Rates

## Acronym Reference Table

Acronym	Meaning
ADHD	Attention Deficit Hyperactivity Disorder
AIRS	Australian Incident Reporting System
AUD	Australian Dollar
AV	Ambulance Victoria
CFA	Country Fire Authority
CFAST	Consolidated Model of Fire and Smoke Transport
CIRS	Clutter Image Rating Scale
CPR	Cardiopulmonary Resuscitation
CREM	Community Resilience Department Emergency Management
DEPI	Department of Environment, Land, Water, & Planning
EMR	Emergency Medical Response
EMT	Emergency Medical Technician
FIRS	Fire & Incident Reporting System
FRNSW	Fire and Rescue New South Wales
LGA	Local Government Area
OCD	Obsessive Compulsive Disorder
MD	Metropolitan District
MFB	Metropolitan Fire and Emergency Service's Board
USD	United States Dollar
WPI	Worcester Polytechnic Institute

## Table of Contents

Abstract .....	II
Table of Figures .....	IV
Table of Tables .....	V
Acronym Reference Table .....	VI
Executive Summary .....	IX
Chapter 1: Background .....	1
1.1 An Overview of Compulsive Hoarding .....	2
1.2 An Overview of Domestic Squalor .....	4
1.3 The Impact and Risk Features of Hoarding and Squalor .....	6
1.4 Victorian Fire Services.....	10
1.4.1 Metropolitan Fire and Emergency Services Board (MFB) .....	10
1.4.2 Country Fire Authority (CFA).....	12
1.4.3 The Changing Community of Victoria and Fire Services Response.....	14
1.5 Victorian Fire Service Response to Hoarding and Squalor.....	15
1.5.1 MFB.....	15
1.5.2 CFA .....	18
1.6 Summary .....	19
Chapter 2: Methodology .....	21
2.1 Identify Hoarding and/or Squalor Incidents in MFB Region of Responsibility .....	21
2.2 Identify Hoarding and/or Squalor Incidents in the CFA Region of Responsibility .....	23
2.3 CFAST Fire Model.....	24
Chapter 3: Results and Analysis .....	29
3.1 Characteristics of All Hoarding and/or Squalor Incidents in the Metropolitan District	29
3.1.1 Reported Incident Rate .....	29
3.1.2 Location .....	30
3.1.3 Incident Type .....	31
3.1.4 Age.....	32
3.1.5 Property Type .....	33
3.1.6 Property Tenure .....	34
3.1.7 Emergency Response Incidents Involving a Deceased Person in a Home with Hoarding and/or Squalor .....	35
3.2 Characteristics of Fire Hoarding Incidents in the Metropolitan District.....	35
3.2.1 Cause of Structural Fire .....	36

3.2.2 Area of Origin.....	36
3.2.3 Containment of Fire.....	37
3.2.4 Presence of Smoke Alarms.....	38
3.2.5 Total Number of Personnel.....	39
3.3 Characteristics of All Hoarding and/or Squalor Incidents in the CFA Region of Responsibility.....	40
3.3.1 Reported Incident Rate .....	40
3.3.2 Location .....	41
3.3.3 Incident Type .....	41
3.4 Characteristics of Hoarding Fire Incidents in the CFA Region of Responsibility.....	42
3.4.1 Cause of Structural Fire .....	42
3.4.2 Area of Origin.....	43
3.4.3 Containment of Fire.....	44
3.4.4 Presence of Smoke Alarms.....	45
3.4.5 Emergency Response Incidents Involving a Deceased Person in a Home with Hoarding and/or Squalor .....	46
3.5 Exploratory CFAST Simulations .....	46
References.....	60
Appendices.....	63
Appendix A: Turn Out Gear.....	63
Appendix B: Blank AIRS Report.....	64
Appendix C: Key Words.....	66
Appendix D: Incident Detail Categories .....	68
Appendix E: Additional MFB Findings .....	70
Appendix F: Additional CFA Findings.....	73



## **Executive Summary**

Residential fires injure and kill thousands of people every year around the world (Fire Death Rate, 2011). Over the past several years fire services are increasingly recognising hoarding and squalor as a common feature in fire and other emergencies. Hoarding is a behaviour involving the collection or accumulation of large quantities of possessions with the inability to discard. In a residential property where hoarding is present, the chance of ignition significantly increases due to the abnormally high fuel load. With hoarding identified as a chronic and progressive psychological condition predicted to affect between 3-5% of the population, the risk is expected to grow (Frost et al, 2003). Hoarding and squalor are two different situations, but they can often co-exist. Squalor is described as an unhygienic and unsanitary living environment. In these cases, individuals may be exposed to biohazards and put at greater risk for illness (Macfarlane, 2013).

The Metropolitan Fire and Emergency Services Board (MFB) in Melbourne, Victoria, Australia have conducted several research studies on hoarding and squalor with Worcester Polytechnic Institute. These studies have provided an evidence base upon which to develop risk reduction advice for MFB firefighters, affected people and the agencies which support them and the broader community regarding hoarding and squalor. MFB is continuing to address the risks associated with hoarding and squalor to improve its organisational response to these incidents. As hoarding and squalor became an organisational priority for the MFB, a higher rate of hoarding and squalor incidents were reported. The limited research on hoarding and squalor on a state-wide level, led the two major Victorian Fire Services, the Metropolitan Fire and Emergency Services Board and the Country Fire Authority, to conduct the first state-wide hoarding and squalor study.

The aim of this research study was to analyse all identifiable hoarding and squalor incidents attended by Victorian Fire Services within the three year period from 3 April 2012 to 3 April 2015. Through the analysis of this information we were able to identify common

trends, features and risk indicators of the incidents associated with hoarding and squalor. In addition, we built upon the New South Wales Fire and Rescue Hoarding burn and used a basic fire model to simulate a hoarding household to explore the fire dynamics in comparison to a normal residential fire (Rebane, 2014).

## **Research Methods**

We created a database that included all identifiable hoarding and squalor incidents from MFB and CFA that occurred within the time period of our study. The MFB and the CFA currently do not have a consistent and shared process or response state-wide for reporting hoarding and squalor incidents. Therefore, we had to rely on collecting data formally and informally to ensure we had identified as many incidents as possible.

There were two primary methods of identifying hoarding and/or squalor incidents in the MFB region. The first method was a key word search through the Australian Incident Reporting System (AIRS). An AIRS report is made after every incident the MFB has attended. We also used the informal and formal referrals of hoarding and squalor incidents to the MFB Community Resilience Department. These referrals had corresponding incident numbers, which were used to search through AIRS.

The primary source of data used for the CFA was the Fire and Incident Reporting System (FIRS). FIRS is a post incident reporting system that only CFA use. An email was sent to 25,000 CFA operational and volunteer firefighters requesting information on any hoarding and squalor incidents that occurred during our study period. These incidents were then searched through FIRS to extract information of each incident.

The database we constructed for all hoarding and squalor incidents included a number of categories to provide information about the incidents such as incident type, location and the presence of a smoke alarm. After all the data was collected and entered into our database, we analysed the data and identified any common features and risk indicators of these

incidents. This analysis consisted of identifying characteristics of hoarding and squalor fires as well as the demographics of the people affected.

To better understand how the fire dynamics of a hoarding fire differ from a normal residential fire, we used the Consolidated Model of Fire and Smoke Transport (CFAST) software. We modelled and simulated five fire scenarios, which included a baseline test with no hoarding, general clutter (CIRS Levels 3 and 4), moderate hoarding (CIRS Level 5) and severe hoarding (CIRS Level 9). The structure was filled with the most frequently hoarded items such as clothes, books, newspapers and magazines (Colpas et al, 2012).

## **Findings**

Our study has identified 188 hoarding and squalor incidents across the state of Victoria from 2012 to 2015. One hundred and sixty four hoarding and squalor incidents were identified in the MFB area of responsibility and 24 were identified in the CFA area of responsibility. These incidents include residential structure fires, non-structure fires, false alarms, and other emergency events. For MFB, we have included emergency medical response incidents because MFB also respond to incidents that involve a non-breathing/non-responsive patient with Ambulance Victoria.

Of all the 164 identified incidents in the MFB region, our findings show that 96% of the local government areas (LGA) in the MFB region had at least one hoarding and/or squalor incident within its boundaries. This supports that hoarding and/or squalor incidents are not confined to one suburb and can occur across the Metropolitan District affecting people from all social classes and educational backgrounds. In the CFA region, we identified a high number of incidents in the growing urban areas. These areas include Geelong, Dandenong, Melton and Lilydale, which are all close to or on the border of MFB's boundary. This suggests that hoarding and/or squalor incidents are not just confined to the MFB region,

and may become more prevalent in high population density areas of the CFA region as urbanization continues.

The reporting rate for MFB during our study period was approximately one hoarding and/or squalor incident every 6.7 days. This rate has doubled since the second MFB hoarding study, which established one hoarding incident reported every 13.8 days (Colpas et al, 2012). Our research identified that with the release of each study and the development of organisational responses including the engagement of firefighters in relation to reporting, the incident rate has increased.

This study has found that 74% of all hoarding residential structure fires in the Metropolitan District were contained to the room of origin. This has increased since the second MFB hoarding study, which found that 60% were contained to the room of origin (Colpas et al, 2012). While there is no definitive answer for this upward trend, it may reflect a relationship between increased organisational and operational awareness and containment to room of origin. In the CFA region of responsibility, 37% of hoarding and squalor fires were contained to the room of origin, which is significantly lower than the CFA's target of 70% containment (2014 Annual Report, 2014). MFB and CFA data both show lower containment rate compared to normal residential fires showing that hoarding fires are much greater in intensity.

Our study has observed that 40% of all residential structure fires in the MFB region had an operational smoke alarm, and 11% in the CFA region. These percentages of hoarding households with an operational smoke alarm are much lower. The average residential households contain 75.5% of an operational smoke alarm. Without an operational smoke alarm present in a hoarding household, the occupant may be slower to identify the fire, self-evacuate and a delay in calling Triple 000 for emergency assistance. This provides time for the fire to spread past the room of origin before fire services have been notified to attend.

After simulating multiple fire scenarios of a hoarding household, our results have shown that CIRS levels 4 and 5 were the most severe fire environments compared to a normal residential fire. In these cases, the likelihood of fire spreading to adjacent rooms is much greater due to the high fuel load. Our simulation has shown that a fire in a level 9 on the CIRS was not as intense as a level 4 and 5 due to the densely packed materials decreasing the oxygen flow to the source of fire. However, a level 9 still poses fire risks due to the increase chance of re-ignition caused by the slow smouldering fire of the materials which may be further compounded by reduced egress for the occupants and access for the firefighters.

### **Conclusion and Recommendations**

Hoarding and squalor in a residential property result in a range of shared and unique risks for the occupant/s, their neighbours and responding firefighters. Our results show that hoarding and squalor incidents are not just confined to the boundaries of MFB, and while the reporting rate within CFA was low, urban growth in the CFA area that increased knowledge of these issues and the need to report them is likely to result in a higher incidence rate as has occurred in MFB. We recommend that the MFB and CFA Community Resilience Department review the findings of this study and develop a joint organisational policy to promote consistent practice. It is recommended that this include CFA adopt information developed by MFB for affected people to reduce their risk and this include the promotion of additional smoke alarms than those required by Victorian Law. It is also recommended that firefighters are engaged to increase their understanding of the issue and the need to report incidents for data collection and the development of shared organisational responses. We also recommend that MFB and CFA work together to scope the practicality of implementing the MFB Hoarding Notification System to build firefighter preparedness and safety.

Finally, we recommend that further research is undertaken in relation to the rate of incidents and their common features on a state-wide basis. Research is also recommended to

explore both the behaviour of fire in hoarding incidents and building performance in relation to fuel loads and the water load required by to extinguish a fire particularly in multi storey and attached dwellings. In conclusion, our research has identified that hoarding and squalor are an ongoing risk even after a fire event unless appropriate support or interventions are provided for affected people. To reduce these risks, integrated, interagency responses are required to deliver improved safety outcomes. To do this effectively, fire services need to develop responses which reflect this practice to address and mitigate the ongoing risks of affected individuals.

## **Chapter 1: Background**

Hoarding is the persistent accumulation of and lack of ability to relinquish large numbers of objects or living animals. It results in extreme clutter in and around premises, compromising the intended use of premises and threatens the health and safety of people concerned, animals and neighbours. Hoarding is a progressive and chronic condition (Victorian Dept. of Health 2012).

Squalor is an unsanitary living environment that has arisen from extreme/prolonged neglect. It poses substantial health and safety risks to people or animals residing in the affected premises as well as others in the community (Victorian Dept. of Health 2012).

Hoarding and squalor have a negative impact on the safety, health and wellbeing of affected individuals. They are also increasingly identified in emergency response incidents which most commonly involve a fire. With hoarding, the large accumulation of items not only provides an increased opportunity for ignition but also blocks internal pathways and exits in the event of a fire. Of all preventable residential fire fatalities in the Metropolitan District of Melbourne, Australia from 2000 – 2009, 24% were due to hoarding related fire incidents due to their inability to self-evacuate (Lucini et al, 2009). In addition, the fire risks of hoarding are not isolated to the affected individuals but shared by the other occupants, neighbours and responding firefighters.

Squalor, which can exist in isolation or with hoarding, includes homes in which environmental neglect extends beyond an unsanitary environment. Often there is no maintenance of, or safety in the use of utilities or appliances which may provide an increased opportunity for ignition. These homes also pose additional risks to the occupants, neighbours and firefighters which often include bio hazards from human waste, infestation of vermin and discarded household waste. While community awareness of these behaviours and the related risks are increasing, additional research, understanding and consistent practice is required to

address them. The Metropolitan Fire and Emergency Services Board (MFB) Community Resilience Department has led research regarding the dangers of hoarding and squalor since 2007 when hoarding was first identified as an emerging risk following three preventable residential fire fatalities within a four month period. While the Country Fire Authority (CFA) Community Resilience Department has participated in some joint activities with MFB, research regarding hoarding and squalor emergency incidents has only been within MFB's area of regional responsibility.

This study was conducted in consultation with the CFA, providing the first state wide analysis of all identifiable hoarding and squalor incidents anywhere in the world. This required working closely with both MFB and CFA personnel at a central and regional/district level to understand their individual organisational structures, the historical and current priorities of each organisation and the collection of incident data for analysis.

### **1.1 An Overview of Compulsive Hoarding**

Compulsive hoarding has an active and a passive component. The active aspect is the collection of items that are not necessary, while the passive aspect is the failure to discard the unneeded items. Severe hoarding behaviour encompasses both of these (Brown & Zsuzsa, 2007). In many cases, hoarding comes from the formation of extreme emotional attachments to inanimate objects. This makes it very difficult for people with hoarding compulsions to relinquish or discard anything. Many affected people also justify their behaviour through the uniqueness of everyday items. For example, they may not discard a five year old newspaper because there will never be one produced that is exactly the same and therefore a wealth of information will be lost (Frost and Hartl, 1996).

### **Causes of Compulsive Hoarding**

Hoarding was included as a separate psychological condition in the International Diagnostic Statistical Manual 5 in 2012 (Hoarding and DSM-5, 2012). Prior to this, hoarding



was identified as part of Obsessive Compulsive Personality Disorder (OCD). OCD is a condition that results in obsessive thoughts and compulsive actions, and causes a pattern of behaviour that can be distressing to the individual. Studies show that approximately 15 – 30 % of patients suffering from OCD have clinically significant hoarding compulsions, suggesting that there is a link between the two (Hoarding and DSM-5, 2012). Research conducted by Professor Michael Kyrios, a leading Australian expert in the treatment of compulsive hoarding stated that “Hoarding affects people from all social classes and educational backgrounds, though it commonly presents alongside depression, obsessive compulsive disorder (OCD), attention deficit disorder, other anxiety problems, compulsive buying, other impulse control problems, and other serious mental health problems” (Hoarding and DSM-5, 2012).

Approximately 50 % of people with hoarding compulsions have a first-degree relative with a documented case of compulsive hoarding. These behaviours may have developed over time due to abandonment issues or the lack of a loving family from a young age (American Psychiatric Association, 2013). Those who fall under this category often try to make up the emotional gap by forming attachments to their possessions.

### **Assessing Hoarding**

Assessing a level of hoarding was identified by Professor Randy Frost as a key element of treatment to assist in the establishment of not only the severity and impact of the issues but also to set measurable goals as part of treatment. This resulted in the development of the “Clutter Image Rating Scale” (CIRS). Now a widely used tool, the scale (which has three versions including bedroom, lounge room and kitchen) consists of a series of nine pictures, each with a varying amount of clutter present, as seen in Figure One. These photos provide measure through which the severity of the clutter in a room can be matched to one of the photos (Victoria Dept. of Health, 2012).

## Clutter Image Rating: Bedroom

Please select the photo that most accurately reflects the amount of clutter in your room.



Figure 1: Clutter Image Rating Scale

Previous MFB/WPI studies have identified that fire fatalities involving hoarding occur at level 5 or above clearly demonstrating the relationship between the level of hoarding and the fire risk. The CIRS is also used by MFB to assess a level of risk inside a home for risk reduction advice, post incident reporting, referrals of affected people identified through emergency response to external agencies for support and inspections of homes with hoarding.

For the first time this study will use the CIRS with a Consolidated Model of Fire and Smoke Transport software (CFAST) to provide a greater understanding of what occurs during a fire and identify if there is additional information which can be applied by Victorian Fire Services.

### 1.2 An Overview of Domestic Squalor

Domestic squalor is a term used to describe a living condition. The Victoria Department of Health defines severe domestic squalor as “living conditions so filthy and unhygienic that almost all observers, in whatever culture, would consider them unacceptable”

(Victoria Dept. of Health, 2012). There is a significant difference between hoarding and squalor. While normal cleaning is more difficult in a hoarding situation, squalor is severe with distinct features involving human and/or animal waste, rotting food, infestation of vermin and accumulated household waste and garbage.

In homes affected by squalor with or without hoarding, the unsanitary living conditions can be confronting to the observer. Incidents attended by MFB firefighters have included homes in which a blocked or inaccessible toilet resulted in the person using containers or an area of the floor, eating rotting food and visible infestation of rats, possums, mice and pigeons. These conditions can lead to infection and disease for the occupants and have a significant impact on neighbours due to odours and the spread of vermin. People living in a situation of squalor are more likely to be unaware of their unhygienic environment.

### **Causes of Squalor**

Hoarded items can create extreme clutter and become so excessive that it inhibits effective cleaning, which can lead to a case of squalor. Not all cases of squalor are a result from hoarding or include hoarding. Some people might neglect or seem to not care of their own cleanliness and do not discard rubbish readily or at all. This may be due to a broad range of health conditions, such as dementia, depression, schizophrenia, drug addiction, alcoholism or injury to the frontal lobes of the brain (Victoria Dept. of Health, 2013).

In younger people squalor may be linked to long term disabilities like intellectual disability and mental health issues. Combined with poor living skills and social and financial disadvantage, intervention and ongoing support can deliver improved outcomes. For older people the profile differs.

There are two pathways to squalor in older people: compulsive hoarding and the passive failure to maintain a clean environment (Macfarlane, 2013). There is limited, but growing evidence that injuries to the frontal lobe are a major factor to squalor in older people

(Macfarlane, 2013). The largest lobe of the brain is the frontal lobe, which is responsible for many functions such as organizing, planning, risk assessment and impulse control.

Impairment or loss of these functions is also likely to have an impact on fire prevention, preparedness and response to fire. Professor Macfarlane's research promotes the need to ensure appropriate clinical assessment to determine capacity to live independently and safely in the community (Macfarlane, 2013).

### **1.3 The Impact and Risk Features of Hoarding and Squalor**

Hoarding and squalor have an impact on the lives of affected people because the normal activities of daily living are harder to perform. During this study we were able to view many pictures of hoarding and squalor incidents. We also visited one hoarding fire scene which demonstrated that simple actions like walking from room to room or preparing a hot meal were more difficult due to the impact of the living conditions inside these homes. We saw that as normal functions of the home diminish, makeshift arrangements for sleeping, cooking, heating and accessing the home were common and with this comes a range of risks.

In 2011, an 82 year old female affected by hoarding was reported missing from her home in the Melbourne inner city suburb of Fitzroy. It was not until 18 months later that Victorian detectives found her decayed body stuck under garbage piled several meters high (White, 2013). It became apparent that the accumulated items had toppled over. This type of incident is not unique to the Metropolitan District. More recently in April of 2015, the mummified remains of a 90 year old woman from San Francisco, California had been found. Officials believe she had died 5 years prior to the discovery. The apartment had been filled with over 300 bottles of urine, dozens of rats, bugs, and other rotting litter which created a stench so bad that the responding firefighters had to wear their breathing apparatus (Raven, 2015). Similarly in January of 2015, the decomposed remains of a 74 year old accumulator in Southampton, England were found in what seemed to be a nest made of collected materials.

A massive pile of papers and cardboard boxes had toppled onto the man and led to his entrapment. The coroner believed he had been deceased for nearly 8 months prior to being found ('Human Hamster', 2015). While the sheer weight of these materials creates a physically dangerous living environment it also can affect the performance of a structure. Modern building codes allow for a design which can take on extreme weight for a short period of time in the event of large social gatherings. However, the massive permanent load of hoarded items causes creep, which is a time-dependent deformation of building materials due to constant stress. After a certain time period, the mass-bearing structures may rupture and collapse. This was the case for a 66 year old collector in Connecticut who died in January of 2015. She had formed stacks of newspapers, magazines, and other materials so dense that her first-floor had collapsed underneath her and into the basement piling clutter on top of her as she fell. Unfortunately, the weight of the material led to her death (Dassanayake, 2015).

For fire services, hoarding presents significant hazards and challenges in an emergency response situation. Measuring these challenges includes a comparison of the common features of hoarding incidents against other residential fire and emergency incidents.

Fire services commonly measure their success rate by the percentage of fires contained to the room of origin. Containing a fire to the room of origin stops the fire from spreading to other rooms and potentially other structures. It decreases the level of structural damage and the need for additional operational response. The MFB contains residential fires to the room of origin in 90% of all incidents (Homchenko et al, 2014). In hoarding fire incidents, it has been found that the MFB rate of containment to the room of origin drops to 60%, indicating that hoarded materials promote the spread of flames through a dwelling (Colpas et al, 2012). A contributing factor to this is likely to be the low smoke alarm compliance rate in these residential properties.

It is law in Victoria to have a working smoke alarm on every level of every home. A smoke alarm provides the earliest possible warning of a fire. This gives occupants the maximum possible time to safely self-evacuate and alert authorities to ensure that firefighters respond as quickly as possible. Early warning of a fire is vital for everyone but for people who hoard time is critical due to the increased challenges of getting out of their home. Despite this it has been found that only 26% of hoarding households have a working smoke alarm compared to the household average of 66% (Homchenko et al, 2014). All the previous MFB/WPI hoarding studies have identified that hoarding fire incidents are more likely to spread past the room of origin, need more firefighting resources to put out the fire and cause more structural damage.

### **Overexertion of Firefighters**

Hoarding fires more often require additional firefighting resources than other residential fires to extinguish the fire due to the excessive fuel load. Firefighters who respond to this type of fire may put their physical health at a greater risk because of the increased workload. According to the U.S. Fire Administration, overexertion and stress are the top leading causes of death for firefighters and other responding emergency service workers, accounting for 45% of on-duty firefighter deaths (Mordecai, 2008). A 2009 analysis of fire related incidents in hoarding households found that hoarding fires require an average of 2.6 pumpers and 17.1 personnel, compared to 1.5 pumpers and 7.7 personnel for residential blazes (Homchenko et al, 2014).

The increased challenges of fighting a hoarding fire came into fruition on September 24<sup>th</sup>, 2010 when firefighters and emergency medical technicians (EMT) responded to a call regarding a high-rise housing complex in Toronto, Ontario. Efforts were made to suppress a fire that had started on the balcony of a single-bedroom hoarding apartment, and quickly spread with the help of high temperatures and strong winds. The lack of a suppression system

and the presence of an immense fuel load allowed the fire to engulf the room and to spread into a hallway that had been described as “a tunnel of hell” by a fire expert (Schorow, 2012). Over 300 firefighters were called the scene where they worked for over eight hours (Schorow, 2012). They ascended up and down 24 flights of stairs carrying their heavy duty 2.5-inch hose lines and wearing approximately 75 pounds of gear, seen in Appendix A (Haddam Volunteer Fire Company, 2013).

A scenario involving this type of accommodation is not unique to Toronto with increased demand for housing resulting in increased high rise development in many countries around the world. Combined these issues clearly demonstrate why there is a growing awareness about hoarding and the related risks in fire services. London Fire Brigade, which sees approximately two hoarding related fires per week, is developing partnerships with community housing to deliver a “collaborative experienced approach to develop best practices in providing a support network for individuals with hoarding tendencies” (Chief Fire Officers Association, 2011). In addition, Fire and Rescue New South Wales, which has had 12% of all residential fire fatalities since 2009 be hoarding/squalor related, has conducted two hoarding room burns in order to better understand the effects that hoarding has on residential fires (Rebane, 2014).

### **Increased Cost**

Although hoarding fires occur less often than normal residential fires, previous studies have identified that the cost to the Metropolitan Fire Brigade can be up to 17 times more expensive than other residential fires. The average cost of a hoarding fire is \$34,000 AUD compared to \$12,000 AUD for residential fires (Homchenko et al, 2014). The cost of the structural damage caused by a hoarding house fire has significantly decreased since 2000 when these fires had an average loss of \$100,100 AUD compared to residential fires at

\$12,600 AUD (Lucini et al, 2009). This may be due to increased containment rates of hoarding fires (Colpas et al, 2012).

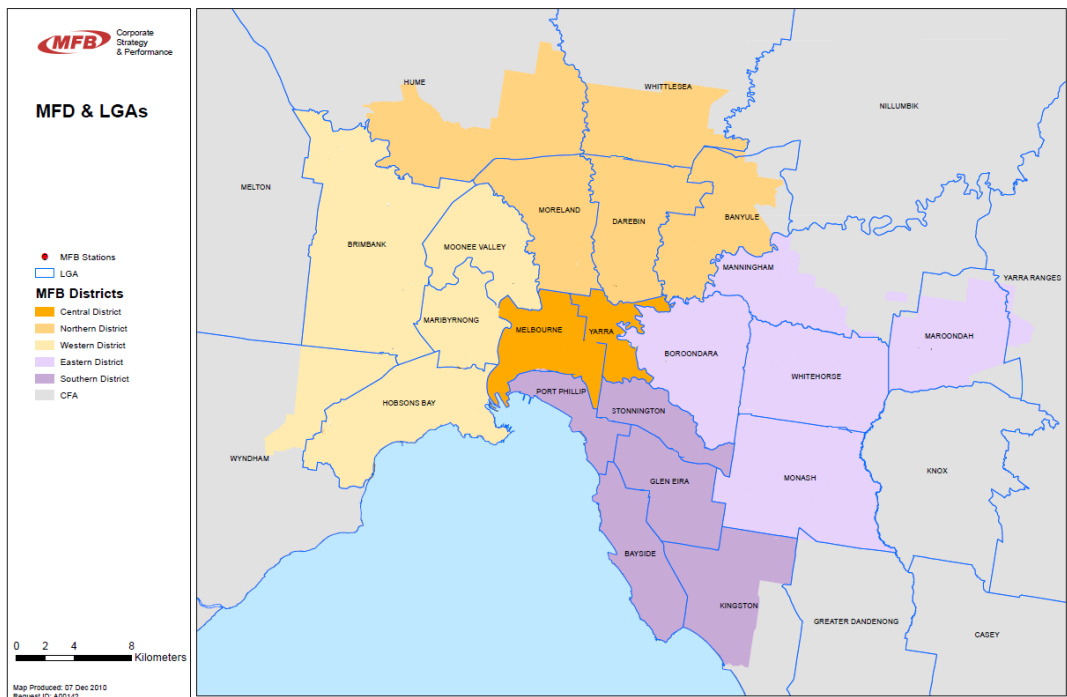
## **1.4 Victorian Fire Services**

In Victoria, the Emergency Management Commissioner coordinates and controls all major emergencies. The Fire Services Commissioner Act established the position of a Fire Services Commissioner to provide leadership to the three fire services in the state of Victoria. These fire services include the Country Fire Authority (CFA), the Metropolitan Fire and Emergency Services Board (MFB) and the Department of Environment, Land, Water & Planning (DEPI) which is responsible for protecting the public lands and forests of Victoria. The Victorian emergency management framework is underpinned by an “all hazards” approach to emergency response. This means the capacity to prevent, prepare, respond and recover for all types of emergencies.

### **1.4.1 Metropolitan Fire and Emergency Services Board (MFB)**

The MFB provides fire and emergency services, improves community safety through research and the development of strategies and activities to reduce risk. MFB protects almost three million people in the Metropolitan District of Melbourne, an area of over 1,000 square kilometres, which reaches across 24 Local Government Areas (LGAs). There are 47 fire stations, which are spread through five districts: Central, Southern, Northern, Eastern, and Western (see Figure 2).





**Figure 2: Metropolitan District Map**

The MFB consists of approximately 1,800 operational staff and 300 corporate staff, which includes temporary staff, trainees, and apprentices (MFB, 2014a). MFB operations respond to approximately 36,000 calls a year, which include fires (structure, non-structure, and bushfire), hazardous incidents, automatic alarm response (including false alarms), urban search and rescue, and road accident rescue (MFB, 2014a). The MFB also responds to emergency medical response incidents alongside Ambulance Victoria when there is an incident that involves a non-breathing/non-responsive individual.

MFB firefighters have a distinct and diverse role working with the community. Since they respond to a wide range of incidents, training is integral. At MFB a formal training framework exists for recruits and promotional courses for rank advancement. In addition MFB firefighters receive regular training sessions which consist of skills maintenance and acquisition. Regional operational commanders also deliver “hot topic” information to each fire station in their district once a month. These sessions often relate to safety on the fire ground, occupational health and safety and new and emerging risks.

The Community Resilience Department is part of the MFB Emergency Response Directorate. The department develops research and evidence as the basis upon which to build policy, practice, strategies, and projects to address risk in an all hazards approach. Community Resilience participates in the delivery of community resilience sessions at all levels of formal training within the MFB including assessable curriculum.

### **Post Incident Reporting System**

Each time the MFB responds to a call, details of the incident are input into the national Australian Incident Reporting System (AIRS) database by a Station Officer. These reports are completed within the four days after the incident has occurred. Some fields of the AIRS form are required to be completed and in a residential fire the information is predominately related to the type of incident, type of structure and other details (See Appendix B for an AIRS report). Firefighters are not required to provide demographic information about the individuals involved in an incident, but if they choose to do so there is an incident description box available.

### **1.4.2 Country Fire Authority (CFA)**

The Country Fire Authority, which covers the greater Victoria area. The CFA is responsible for the vast majority of the state, including many rural and remote areas as seen in Figure 3. CFA operations provide a number of services which include residential fire suppression, road rescue and technical rescue (i.e. high angle, trench and mine operations) (Country Fire Authority, n.d.). CFA also has primary responsibility for the state's response to bushfire. Events like the Black Saturday bushfire (2009) in which 173 Victorians died, demonstrate why bushfire safety remains a significant and core responsibility.



**Figure 3: Map of CFA region (MFB region highlighted in yellow)**

The CFA has evolved from several community based fire brigades to become one of the world's largest volunteer based emergency service organisations. The CFA has over 59,000 volunteers with around 1,800 permanent career firefighters spread across a total of 1,187 brigades with the breakdown being: 32 integrated (permanent and volunteer), 204 urban (mainly permanent), and 951 rural (mainly volunteer) brigades.

Due to the large percentage of mostly rural brigades, the volunteer staff are an important part of CFA. Most volunteers have jobs aside from the brigade but can be called to an emergency at any point of the day via notification from a pager. When paged, volunteer firefighters proceed to their respective station and turn out to the emergency. This differs from the actions of permanent staff members who are already stationed at the brigade and are able to dispatch within 90 seconds of receiving the emergency alarm.

With two different types of firefighters in the CFA come two different training methods, which are developed by training coordinators. Upon joining, volunteers are given a CFA informational packet and bushfire manual. In addition, they receive basic training where they learn skills such as: manning a fire hose and performing CPR. To further their

knowledge they can choose to attend different training modules related to different emergency tasks. Permanent staff members are required to attend a 16-week program where they are put through rigorous tests and trained in bushfire and structural fire response. Every fire station has a set schedule for ongoing training dependent on the community needs and resources of that specific area. CFA's Community Resilience Department is not involved in the training of permanent or volunteer staff.

### **Post Incident Reporting System**

The Country Fire Authority uses a version of the Australian Incident Reporting System (AIRS) called the Fire & Incident Reporting System (FIRS) to record each incident that they attend. The interface of FIRS is very similar to AIRS and has some of the same informational fields such as: location of the incident, report number, actions taken, incident description, type of occupant, damage to the property, etc.

There are separate methods in which volunteer and permanent staff complete this post incident report. For permanent firefighters, the senior officer on duty will fill in the post incident data fields in FIRS electronically and submit the form on an online system no more than four days after the event as per the MFB process. Volunteer staff complete a hard copy version of FIRS and then call the control centre where they then dictate the fields that they have filled in and this is inputted by another person. This is generally done within a week of the incident occurring.

### **1.4.3 The Changing Community of Victoria and Fire Services Response**

The boundaries between the regions of operation for the Metropolitan Fire and Emergency Services Board and the Country Fire Authority were established in 1958. The separating borders were based upon what was then perceived as the metropolitan and rural areas of Victoria. The MFB managed response for the city and suburbs of Melbourne, while the CFA had responsibility for the "country" including large townships.

Over the past 57 years these boundaries have remained the same, but the profile of areas have changed. The outer urban suburbs of Greater Melbourne have grown tremendously, spreading urbanized residential areas into the CFA region of responsibility. In 2012, 5,958 hectares (14,722 acres) were added to the Urban Growth Boundary of Victoria in order to bring forward enough land for 90,000 new residential blocks in Greater Melbourne (MPA, 2012). Previously rural areas under the protection of the CFA such as Melton, Hume, Whittlesea, Mitchell, Casey and Cardinia fell within this area and began to be urbanized (MPA, 2012). The population around Greater Melbourne continues to grow at the quickest rate in Victoria, accounting for 89% of the state's total growth from 2012-2013 (Australian Bureau of Statistics, 2014). Population growth, housing affordability, improved transport links and lifestyle have resulted in an increased number of Victorians living in or near large rural cities, such as Bendigo, Ballarat and Geelong, and the urban rural fringe.

## **1.5 Victorian Fire Service Response to Hoarding and Squalor**

### **1.5.1 MFB**

MFB included information about hoarding and squalor in the Emergency Response Guidebook used by operational firefighters. This covers the operational risks and considerations when responding to these types of events to increase firefighter preparedness and safety. To promote a longer term improved safety outcome for affected people, MFB has developed a process in response to people affected by hoarding and squalor who are identified through emergency response. After a fire or other emergency incident, a MFB firefighter can refer an issue of ongoing risk identified at the incident to the Community Resilience Department Emergency Management (CREM) for follow-up. Referrals are submitted by email or through the use of the MFB's internal Residential Risk Referral online submission form. The department then assesses the individual risks of a situation and refers the person to the most appropriate external agency or programs. This is done on the basis that

in addition to the fire risk, affected people experience a range of other complex risks related to broader issues and that the risk is ongoing. While the fire risk of hoarding properties is the primary interest and responsibility of MFB, other agencies and programs are better suited to respond to and work with affected people to improve their safety, health and well-being. In some instances a referral can include identifying if there has been previous contact or an existing relationship between the individual and a community agency and reconnecting the person. Listed below are several of the agencies and programs that MFB commonly engages (Homchenko et al, 2014).

- Public and Community Housing Providers
- Aged Psychiatric Assessment and Treatment Teams
- Adult Mental Health Services
- Disability Services
- Aged Care Assessment Services
- Acute Health and Rehabilitation Services – Social Work
- Local Government Aged and Disability Services
- Local Government Local/By Laws and Environmental Health Departments Office of Housing

The second type of referral is from external agencies to the MFB Community Resilience Department to the Hoarding Notification System.

### **Hoarding Notification System**

The MFB Hoarding Notification System places a discreet electronic alert on a property address where hoarding is assessed at a level of increased risk of fire. The alert remains inactive until it corresponds to an address that the firefighters are dispatched to in the case of an emergency. At this point, it notifies firefighters that they will be entering a property with a high fuel load with the aim of increasing preparedness and safety. Eligibility

to the system is that the property must be located within the Metropolitan District, which is outlined in Figure 2, the hoarding exhibited must be at a level five or higher on the Clutter Image Rating Scale, and the property must have at least one working smoke alarm (Hoarding Notification System, n.d.). The system was developed after consultation with MFBs external legal services provider, the Victorian State Government Solicitors Office, in house legal counsel, firefighters and the United Firefighters Union. MFB does not promote the system to the general public, but rather works with individuals affected by hoarding, their immediate family, general medical practitioners, psychologists, and other support agencies. This is on the basis that MFB does not have the capacity of responsibility to be the first point of contact for the notification of hoarding properties from the general public. The information acquired for the Hoarding Notification System is not shared with external agencies, and the system has no capacity to identify individuals, only property addresses.

### **Inspections**

In some instances, MFB Community Resilience Emergency Management (CREM) may also conduct an inspection of a hoarding property. Inspections are conducted at the request of an external agency which is working with an affected person with both the individual and the agency being present at the time of the inspection. The aim of the inspection is to identify the risks related to fire, egress and access and prepare a written report for both parties. In some instances MFB CREM also receives requests as part of process related to Residential Tenancy Tribunal matters, Magistrates Court and Child Protection processes.

### **External Engagement**

Since 2007 MFB CREM has allocated resources to raising awareness of the issue of both hoarding and squalor to promote an integrated interagency approach. This has included presentations to individual agencies and at regional forums and conferences at a local, state

and national level. MFB also lobbied for and has participated in the State-wide Hoarding and Squalor Taskforce and is currently represented on five separate regional hoarding network groups within the MD. Risk reduction advice has been available via the MFB website since 2009.

### **1.5.2 CFA**

The Country Fire Authority's vision of "working with communities to keep Victorians safe from fire and other emergencies" is shown through their collaboration with community and state funded programs (Country Fire Authority, n.d). The CFA is part of the City of Greater Geelong's community "Cross Divisional Hoarding Project" which aims to promote and address the growing hoarding problem. This local community initiative, which opened up to outside organisations in 2010, encompasses members from fire, aged-care, mental, home and community services. This hoarding network is unique to the city of Geelong and holds regular meetings and community forums to engage other agencies and raise awareness of this issue. As a result of this network, they have produced service and community guides to provide a clear definition of hoarding and to highlight the process of referring individuals who are affected by hoarding to the appropriate service providers. Like in the Metropolitan District, the Geelong Hoarding Network is not representative of consistent response in local government areas by the state of Victoria.

### **Hoarding Notifications**

In some regions of the Country Fire Authority's area of responsibility there are local responses to the identification of hoarding and squalor properties. However, this practice is not widespread or consistent throughout the CFA. In areas where they do have a hoarding notification system, there is no formal process or protocol for properties to be added to the list.

### **Inspection**



Due to the large regional area of responsibility which CFA manages, it does not have the organisational capacity to conduct hoarding inspections. This would require the development of policy and practice, training and coordination of delivery in all CFA regions.

### **External Engagement**

Since hoarding was first identified as an issue by the MFB in 2007, CFA Community Resilience Department has been an active partner and participated in joint activities where resources have allowed. CFA and MFB both participated in the State-wide Hoarding and Squalor Taskforce with a joint position in relation to the risks and the need for an interagency approach. CFA has also participated in various forums and presentations in partnership with MFB at a local, regional and state level. CFA Community Resilience has also previously allocated resources to scoping these issues in several regions around the state. The report identified that knowledge about the issue was low and that while some areas confirmed these types of incidents occurring, there was no consistent pattern.

### **1.6 Summary**

Over the past six years, the MFB has made significant progress in uncovering the prevalence of hoarding and squalor in the Metropolitan District. It has also allocated significant and consistent resources to promoting awareness and engaging external stakeholders since convening the state's first hoarding forum in 2008. The initial study (2009) identified fires in which hoarding contributed to fire severity or fatalities in the Metropolitan District from 2000 to 2009 (Lucini et al, 2009). The second study (2012) expanded the scope of research to involve all hoarding related incidents that were attended by the MFB from 2009 to 2012. This included fires and other emergency response incidents (Colpas et al, 2012). The most recent study (2014) incorporated another important aspect into their research and identified all hoarding and squalor related incidents that occurred in the Metropolitan District from 2012 to 2014 (Homchenko et al, 2014). In each study the

reporting rate of these incidents has increased in tandem with increased organisational knowledge.

The major priorities of this study are to quantify an incident rate and provide a comparison of reporting within the areas of regional responsibility of each fire service. It will also examine the areas in which they occur, common demography of affected people, causes of fire, containment, property type and tenure, and the allocation of firefighting resources consistent with the previous studies but inclusive of the CFA region. It will also examine any inconsistencies in reporting between fire services and provide analysis of possible underlying causes to any differences in reporting. For operational firefighters across both fire services we will also explore if there is additional information which can be developed to increase their occupational health and safety when responding to these incidents and increase their preparedness and safety.

## **Chapter 2: Methodology**

The main goal of this project was to obtain information about and quantify the characteristics of all emergency incidents involving hoarding households and/or squalor in the state of Victoria from April 3, 2012 to April 3, 2015. This was met through the completion of the following objectives:

- To identify all hoarding and squalor related notifications that occurred in the MFB area of regional responsibility from 2012 – 2015.
- To identify all hoarding and squalor related incidents that occurred in the CFA area of regional responsibility during our study period, 2012 – 2015.
- To analyse all documented hoarding and/or squalor incidents in Victoria to identify common trends.
- To explore the fire dynamics of hoarding fires in relation to normal residential fires.

### **2.1 Identify Hoarding and/or Squalor Incidents in MFB Region of Responsibility**

We were tasked with identifying all incidents that occurred during the last year of our study period, April 3, 2014 - April 3, 2015. The incidents that occurred during the first two years of our study period, April 3, 2012 - April 3, 2014, were previously identified and provided to us by another MFB hoarding study group (Homchenko et al, 2014).

There were two primary methods of identifying hoarding and/or squalor incidents in the MFB region. The first was the use of referrals made to the MFB Community Resilience Department by firefighters and service providers regarding identified hoarding residences. The second was an extensive key word search through the Australian Incident Reporting System (AIRS). We also completed an address search in order to identify any repeated incidents at a given location.

#### **MFB Hoarding and/or Squalor Referrals**

We began by sorting through all referrals made by operational firefighters to the MFB Community Resilience department from April 3, 2014 – April 3, 2015. To determine if a referral indicated hoarding and/or squalor, the document was read in full and searched for key words and phrases identified in past research as words indicating that hoarding or squalor was potentially present. A sample of keywords can be seen in Table 1, and the complete list can be found in Appendix C (Homchenko et al, 2014).

**Table 1: Sample Key Words**

Debris	Poor
Excess	Rotting
Hampered	Stink

Upon identifying a referral that related to hoarding or squalor, the AIRS report was printed out and attached. The information from both the referrals and the AIRS report was recorded in a database. The categories of this database included: Age of Occupant, Street Address, Suburb, Was Hoarding Present?, Was Squalor Present?, Responding Officer, Call Number, Incident Type, Occupant Gender, Property Type, and Property Tenure. For fire incidents, additional categories included: Cause of Fire, Containment Status, Presence of Smoke Alarm, Room of Origin, Total Number of Personnel, Total Number of Pumpers and Appliances, and Estimated Structural Dollar Loss. A further breakdown of how each category was measured can be seen in Appendix D. While the majority of this information was extracted from both the referrals and the AIRS reports, some information was not always present. In these cases, we recorded as much information as possible for later analysis.

### **Identify Hoarding and/or Squalor Incidents in AIRS**

Since referrals are not always made when a hoarding or squalor related incident occurs, a search using the AIRS database was important to identify any additional hoarding

or squalor incidents. Data from April 3, 2014 to April 3, 2015 was exported from the AIRS database. There were over 43,000 incidents to search through including false alarms, residential structure fires, emergency medical responses, non-structure fires, and other incidents. To find any incidents that may have involved hoarding or squalor, we searched the database of all 43,000 incidents using a list of keywords identified in past research to suggest hoarding and/or squalor, see Appendix C (Homchenko et al, 2014). The search process was completed using the procedure below:

1. Use the "Find All" function of Excel to search for every instance that the keyword is mentioned in the description box for each incident.
2. Read the description of every incident that displays the key word and determine whether hoarding and/or squalor is being described.
3. Record confirmed hoarding and/or squalor incidents in our database.

Upon compiling all hoarding and/or squalor incidents that occurred in the Metropolitan District from April 3, 2014– April 3, 2015, we performed an address search through the exported AIRS data from the entire study period. The purpose of this was to identify additional incidents that occurred at each hoarding household, which had not been found through the initial keyword search of AIRS. The address search was performed using the “Find All” function of Excel. Any additional incidents found were recorded in our database.

## **2.2 Identify Hoarding and/or Squalor Incidents in the CFA Region of Responsibility**

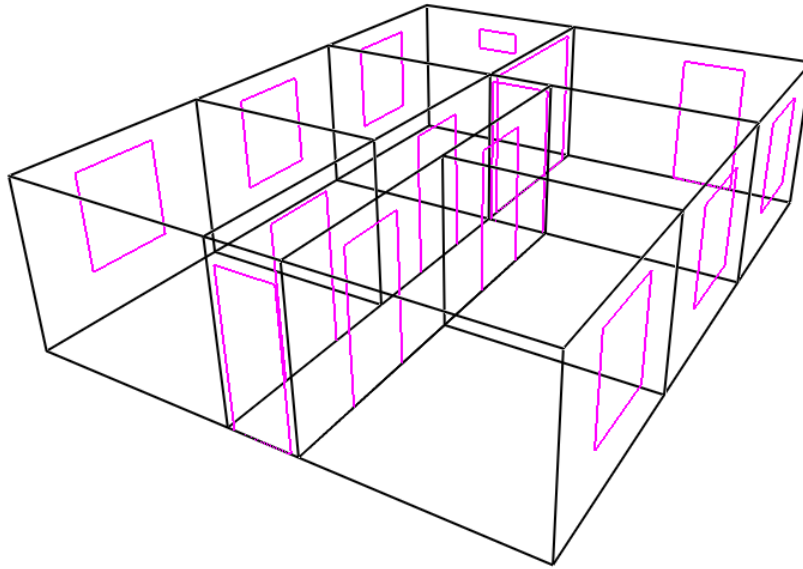
### **CFA Hoarding and/or Squalor Referrals**

For hoarding and squalor incidents within the Country Fire Authority, information was requested from CFA permanent and volunteer operational staff via email. A CFA station officer sent an email to over 25,000 firefighters requesting information on any hoarding and squalor emergency incidents that occurred from April 3, 2012 – April 3, 2015. This email

requested the date of the event, report number, level of hoarding, age/ gender of occupants, and number of occupants in the residence. In addition, an article was posted in the 2015 Autumn edition of CFA's magazine "The Brigade", which is sent out to all permanent and volunteer staff. This also requested that information on hoarding and squalor incidents be referred to the CFA station officer. All incidents referred to the station officer were then forwarded to us. In addition, we retrieved the FIRS report for each incident from the CFA. The same process for extracting data from the MFB referrals and reports was used and all information was recorded in our database.

### **2.3 CFAST Fire Model**

In order to better understand how the fire dynamics of a hoarding fire and to see how it differs from a normal residential fire, we modelled and simulated five fire scenarios. We conducted a baseline test with no hoarding, general clutter (Level 3 and 4 on CIRS), moderate hoarding (level 5 on CIRS) and one scenario with severe hoarding (level 9 on CIRS). We performed this with the use of Consolidated Model of Fire and Smoke Transport software (CFAST). This is a two-zone fire model that can calculate the evolving distribution of smoke, fire gases, and temperature throughout compartments of a building during a fire (NIST, 2013). We first created a structure which can be seen in Figure 4.



**Figure 4: Empty CFAST Structure**

This one-level structure (7m x 9m x 2.4m) was constructed by entering a certain set of dimensions into CFAST, which creates the walls represented by black lines. The next step was to create features such as doors (2.1m x 1m) and windows (1.4m x 1.25m), which are represented by the pink lines. There were a total of six rooms, with the front four being general purpose rooms (3m x 3m) and the back left being a kitchen (3m x 3m) and back right being a living room (4m x 3m) and one main corridor (1m x 6m). These dimensions were based off of a hoarding house that was identified during our study period and are compliant with Australian building standards. After the structure was created, we then added materials to burn during the simulation, also known as targets. Since the most frequently hoarded items, such as clothes, letters, bill statements and books, are cellulose based we chose to input targets that have similar heat release rates and heat of combustion values. The arrangement of these targets was consistent with the patterns of hoarding; starting from the surrounding walls and progressively moving towards the centre of the room. Hoarding was only modelled in areas immediately affected by the fire, such as the back two rooms and the main corridor. The

other rooms were left empty and were there to see the effects that the smoke had on these areas. For the five simulations that we conducted, the fire begins in the living room by a paper waste basket due to its similarity to the most commonly hoarded items. We then placed that waste basket next to the sofa on the front wall to ensure a consistent fire growth through the three simulations. To ensure proper ventilation into the structure consistent with residential households, both kitchen windows and the back door of the living room were modelled to be open by a fraction of 0.02 (2%). In simulations 2-5, we modelled a window to break once the upper layer gas temperature reached 390 C (Babraukas, 2010). The targets in each test were as follows:

### **Simulation 1: No hoarding**

Living Room:

- TV set in the back left corner
- Two sofas along the front and right walls.
- One curtain over the window on the right wall

Kitchen:

- Two curtains over the left and rear window
- Countertop on the front facing wall

Hallway: No Items in the hallway

### **Simulation 2: Level 3 on CIRS**

Referencing the CIRS we chose the following measurements for a level 3 on the CIRS.

Living Room: Same as Simulation 1 with a cellulose based target located one metre from the floor and protruding one metre from the right wall.

Kitchen: Same as Simulation 1 with a cellulose based target located 0.25 metres above counter.



Hallway: Cellulose based target located 0.5 metres from the ground and protruding 0.25 metres from each wall

### **Simulation 3: Level 4 on CIRS**

Referencing the CIRS we chose the following measurements for a level 4 on the CIRS.

Living Room: Same as Simulation 1 with a cellulose based target located one metre from the floor and protruding one metre from the rear and right walls.

Kitchen: Same as Simulation 1 with a cellulose based target located 0.25 metres above the counter. We also had targets located one metre from the floor and protruding one metre from the left and rear walls.

Hallway: Same as Simulation 2.

### **Simulation 4: Level 5 on CIRS**

From pictures of hoarding households and referencing the CIRS we chose the following measurements for a level 5 hoarding case.

Living Room: Same as Simulation 1 with a cellulose based target located one metre from the floor and protruding one metre from each wall.

Kitchen: Same as Simulation 3

Hallway: Same as Simulation 2.

### **Simulation 5: Level 9 on CIRS**

From pictures of hoarding households and referencing the CIRS we chose the following measurements for a level 9 hoarding case. Due to the limitations of the CFAST program, we could only model a level 9 on the CIRS in the living room and had to delete targets in the kitchen of the model. The targets selected were deemed to not have a significant impact on the overall results of the program and accurate results were still measured.

Living Room: Same as Simulation 1 with a cellulose based target located 1 metre from the floor and protruding 1 metre from each wall. In addition, we added targets 1 metre from the floor and protruding 0.65 metres from each wall.

Kitchen: We chose to eliminate the two curtains and have a cellulose based target located 0.25 metre above the counter. We also added targets located 1.25 metres from the floor and protruding 1.25 metre from the left and rear walls.

Hallway: Same as Simulation 2.

## Chapter 3: Results and Analysis

This study uncovered 188 hoarding and/or squalor related incidents across the state of Victoria between April 3, 2012 and April 3, 2015. Of these confirmed incidents 164 occurred in the Metropolitan Fire and Emergency Services Board's region of responsibility and 24 occurred in the Country Fire Authority's region of responsibility. These incidents included but were not limited to structural fires (preventable residential), emergency medical response (EMR), false alarms, non-structural fires and other events. The findings amongst identified MFB incidents were compared with those of the previous hoarding studies in order to identify changing trends (Colpas et al, 2012). Our completed analysis of all incidents uncovered the changing risk indicators associated with hoarding and squalor.

### 3.1 Characteristics of All Hoarding and/or Squalor Incidents in the Metropolitan District

In this section, all 164 hoarding and/or squalor incidents that occurred in the MFB's region of responsibility were analysed to identify underlying trends, common features and risk indicators. The variables that we assessed included but were not limited to incident rate, incident type, property type and tenure and where possible the age of the occupant.

#### 3.1.1 Reported Incident Rate

From April 3, 2012 to April 3, 2015 there were 164 confirmed incidents involving hoarding and/or squalor, and of these 164 incidents nine resulted in death. Over this three year period, one incident occurred approximately every seven days. Table 2 shows that the 2012 hoarding study identified a hoarding incident once every 13.8 days, compared to the current study's finding of a hoarding incident once every 6.7 days (Colpas et al, 2012).

**Table 2: Comparison of Incident Rates**

<b>Time Frame</b>	<b>Days Between Incidents</b>
2012-2015	6.7
2009-2012	13.8

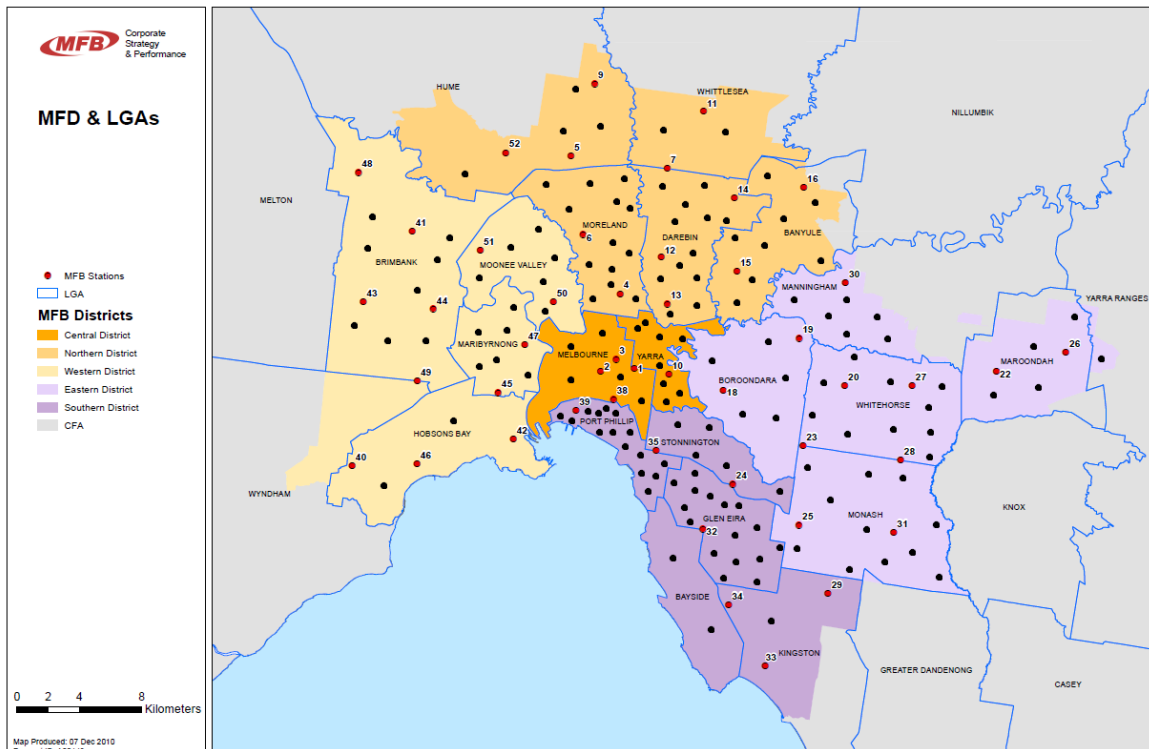
**Table 3: Yearly Incident Rates**

<b>Time Frame</b>	<b>Days Between Incidents</b>
2014 - 2015	6.0
2013 - 2014	5.4
2012 - 2013	10.4

FINDING: The rate of hoarding and/or squalor incidents being reported has increased since 2012.

### **3.1.2 Location**

The local government area (LGA) information related to each incident was recorded in the AIRS database. In 23 of the 24 LGA's represented in the MFB's region of responsibility, there was at least one hoarding incident that occurred during this study period. Over the past year, four of these 23 LGA's reported their first incident since April 3, 2012. The geographical distribution across LGA's and districts can be seen in Figure 5.

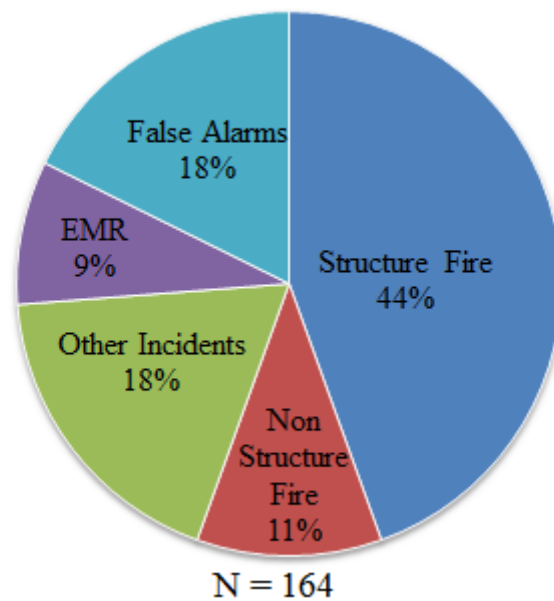


**Figure 5: Hoarding and/or Squalor Related Incidents within the Metropolitan District**

**FINDING:** At least one hoarding and/or squalor incident has occurred in 96% of local government areas during this study period, which indicates a wider spread of incidents than found by the 2012 hoarding study (Colpas et al, 2012).

### 3.1.3 Incident Type

The types of incidents were analysed to determine various types of emergency assistance was required by affected people. From 2012- 2015 the MFB responded to 73 residential structure fires, 30 other emergency incidents such as lock-outs and lock-ins, 29 false alarms, 18 non-structure fires, and 14 emergency medical response (EMR) incidents regarding hoarding and/or squalor. As seen in Figure 6, structural fires make up 44% of all hoarding related incidents. Overall, structural and non-structural fires make up 55% of all hoarding incidents.

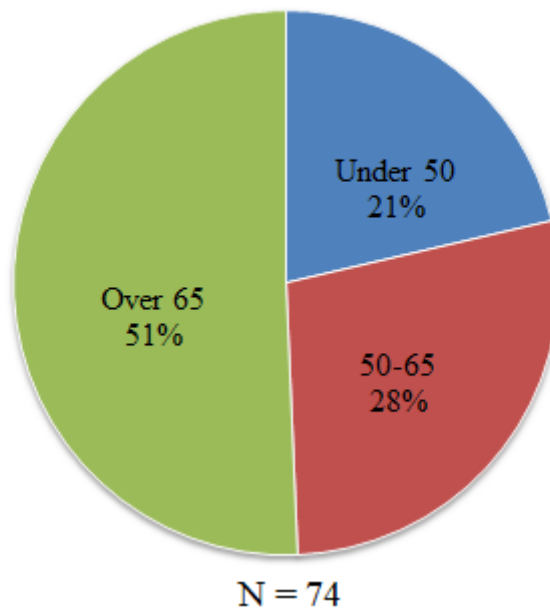


**Figure 6: Distribution of Incident Type of Hoarding and/or Squalor Related Incidents**

FINDING: Fires have remained the predominate cause of identified hoarding and/or squalor incidents since the 2012 hoarding study (Colpas, 2012).

### 3.1.4 Age

The age of the occupant involved in a hoarding and/or squalor incident was analysed to identify trends that may suggest a certain age group is at a higher risk. Of the 164 incidents that the MFB responded to during this study period, 74 specified the age of the occupant due to the fact that AIRS does not require the age of the victim. As seen in Figure 7, 51% of these incidents involved an adult over the age of 65.

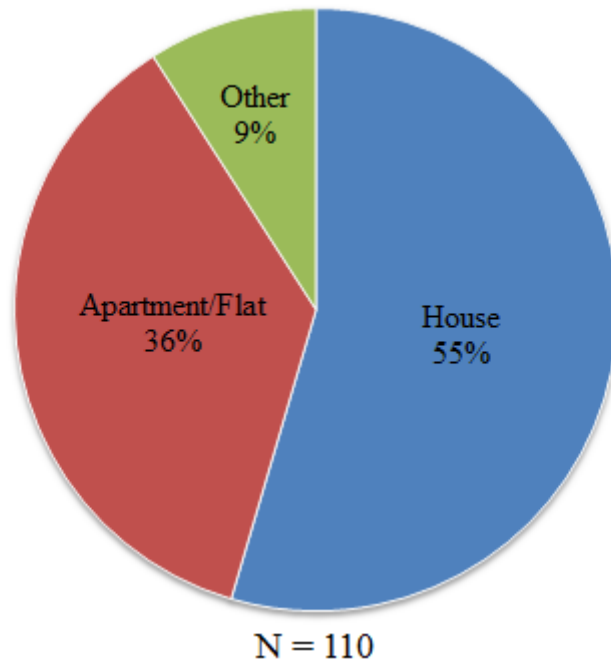


**Figure 7: Age Distribution of All Hoarding and/or Squalor Related Incidents**

FINDING: Older individuals have been identified as an at risk group in regards to hoarding and/or squalor, with the number of incidents involving 50-65 year olds having increased by 23% since the 2012 hoarding study (Colpas et al, 2012).

### 3.1.5 Property Type

Residential housing in Victoria is predominately comprised of free standing houses, semi-detached houses, units, apartments and can include bungalows (a smaller freestanding single bedroom unit in the rear yard) and caravans. The property type is the first component to identify where risk might be shared with neighbours regarding the impact of health/fire risks. The property type was recorded for 110 out of the 164 possible incidents that the MFB responded to during this study period. From these 110 incidents, 60 incidents involved a house, 40 involved an apartment/flat, and 10 involved some other type of structure such as a shed, automobile, or garage as seen in Figure 8.



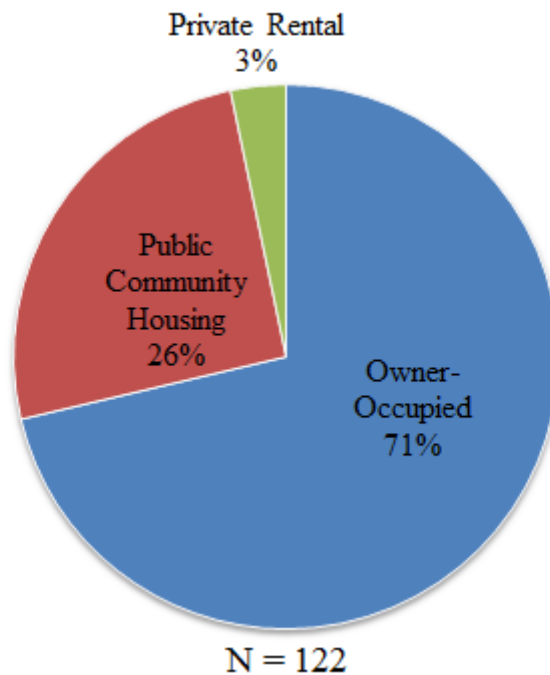
**Figure 8: Property Types of All Hoarding and/or Squalor Related Residence**

FINDING: 36% of incidents occurred in properties that shared structures (i.e. walls, ceilings, and floors) with neighbouring properties, which is an 8% increase since the 2012 hoarding study (Colpas, 2012).

### 3.1.6 Property Tenure

Property tenure is the legal arrangement as to which an individual has the right to occupy a property in a private home, or as a tenant (Tenure, 2011). Information related to property tenure provides insight to the profile of affected people. It suggests how they may be engaged by external stakeholders who potentially share the risk, such as the owner of the property or managing agency if it is not owner occupied. If tenure of the property is on the basis of rental either from a public, community, or private landlord this may expose these entities to risk also. As this is not a required field in AIRS, there were 122 out of 163 incidents where property tenure was recorded. As seen in Figure 9, this study found that 71% of the properties were owned by the occupant, 26% were public/community housing, and 3% were privately rented.





**Figure 9: Property Tenure of Hoarding and/or Squalor Related Residences**

FINDING: The number of incidents that occurred in public housing increased by 7% since the 2012 hoarding study (Colpas et al, 2012).

### **3.1.7 Emergency Response Incidents Involving a Deceased Person in a Home with Hoarding and/or Squalor**

Of the 164 hoarding and/or squalor incidents identified in our study period, we identified eight incidents of which were involved a deceased person. Of these eight incidents, one involved a preventable residential fire fatality. The other seven incidents involved assisting Ambulance Victoria (AV) on an emergency medical response. This indicates that individuals who hoard or live in squalor face significant non-fire risks.

### **3.2 Characteristics of Fire Hoarding Incidents in the Metropolitan District**

In this section, 73 preventable residential hoarding fire incidents out the total of 164 were analysed to identify underlying trends that may serve as risk indicators. The variables that we assessed included but were not limited to cause of fire, point of origin, and the presence and operational status of smoke alarms.

### 3.2.1 Cause of Structural Fire

The most common causes of fire aid in creating fire prevention policies regarding hoarding and squalor residences. They also provide an insight as to what type of activities the occupant may have been doing during the time prior to the fire. Of the 73 preventable residential fire incidents identified, the two most common causes of fire were heat/open flame (34%) and electrical (22%). Figure 10 shows the distribution of the causes of hoarding fire incidents.

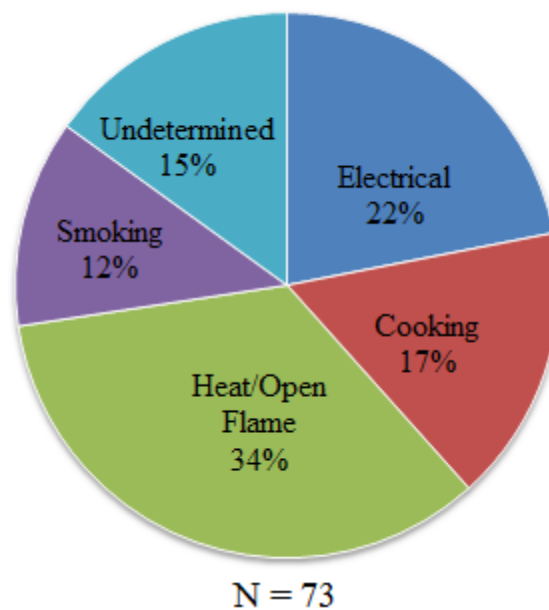


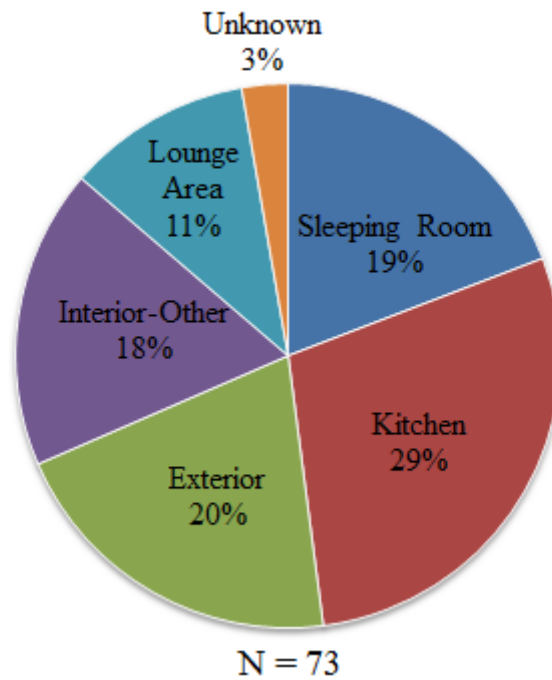
Figure 10: Causes of Hoarding Related Fires

FINDING: The two most common causes of fire have remained consistent since the 2012 hoarding study (Colpas et al, 2012).

### 3.2.2 Area of Origin

The area of origin is associated with the cause of fire; therefore this data will provide insight on the different purposes of rooms in a hoarding household. For the purpose of this analysis, only structural fires were examined. To display our findings we created an "Exterior" category in which we classified areas including lawn, yard, decks, and terrace. Rooms such as bathrooms, foyers, dining rooms, and laundry rooms were classified in the

“Interior-Other” category in order to stay consistent with previous studies (Homchenko et al, 2014). Figure 11 shows the distribution of the room of origin for all structural hoarding fires.

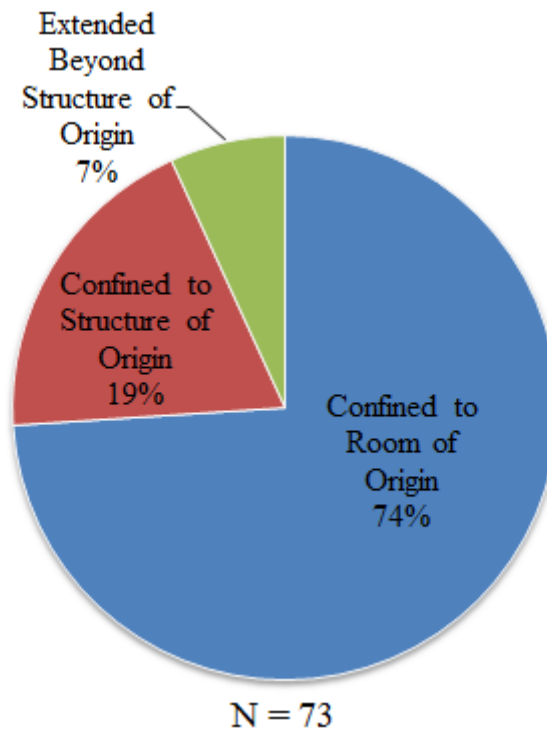


**Figure 11: Area of Origin for Hoarding Related Fires**

FINDING: Similar to the findings of the 2012 hoarding study, there is no one area that has a significantly increased risk of fire occurring (Colpas et al, 2012).

### **3.2.3 Containment of Fire**

Containment of a fire to the room of origin reduces potential structural damage, decreases the chances of entrapment, and is less likely to develop into a severe fire impacting neighbouring structures. This study found that the MFB contains 74% of hoarding fires to the room of origin, as seen in Figure 12.

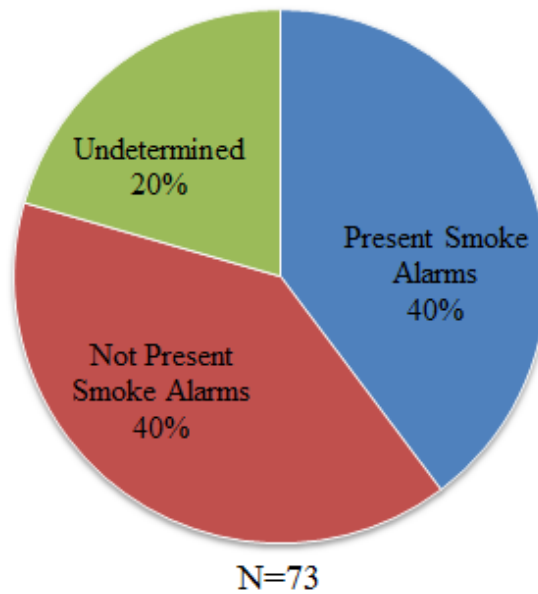


**Figure 12: Containment of Hoarding Related Fires**

FINDING: The containment to room of origin for hoarding structural fires has increased by 14% since 2012, though it remains less than the average 90% containment rate for normal residential fires (MFB Annual Report, 2014).

### 3.2.4 Presence of Smoke Alarms

The presence of an operational smoke alarm means that the occupant will be provided with the earliest possible warning of a fire and be able to get out and raise the alarm by calling Triple Zero ,000. This shortens emergency responder response time, which in turn can decrease structural damage and prevent significant growth of the fire. This study found that 40% of the households had an operational smoke alarm, 40% did not, and 20% had no information provided as seen in Figure 13.

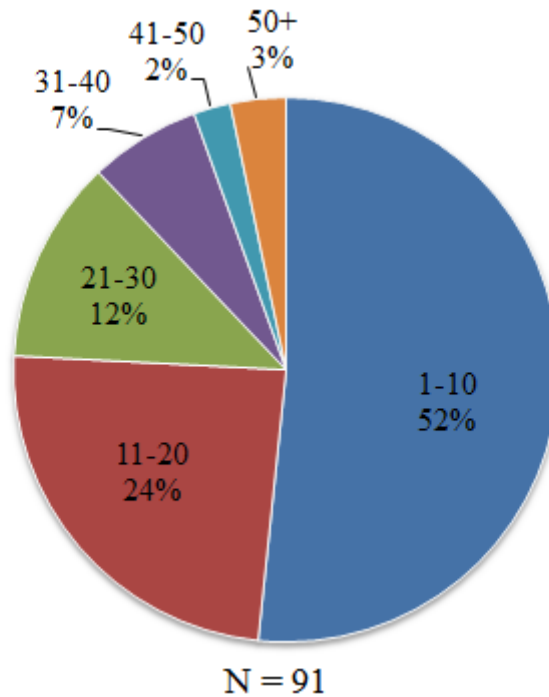


**Figure 13: Presence of Smoke Alarms in Hoarding Residence**

**FINDING:** The presence of smoke alarms in hoarding properties has not changed significantly since the 2012 hoarding study, and still remains lower than the average residential property smoke alarm presence of 86.4% (2014 Annual Report, 2014).

### **3.2.5 Total Number of Personnel**

The number of personnel identifies the resources required to put the fire out which is one element of estimating the severity of a fire scenario. Across 92 identified hoarding fires, 48% required over 11 personnel as seen in Figure 14.



**Figure 14: Number of Personnel Attending Hoarding Related Fires**

FINDING: The number of hoarding fire incidents that require 11 or more firefighters has decreased by 9% since the 2012 hoarding study (Colpas et al, 2012).

### **3.3 Characteristics of All Hoarding and/or Squalor Incidents in the CFA Region of Responsibility**

One major limitation that we faced throughout this study was the small sample size of incidents that occurred in the CFA region of responsibility. This inhibited us from drawing strong conclusions regarding the risk-indicators specific to the CFA area. The following results will provide a baseline for future research that may be conducted. In addition, some variables that were assessed for MFB's region of responsibility were not available, such as age, property tenure and total number of personnel; therefore, analysis on these variables was not conducted.

#### **3.3.1 Reported Incident Rate**

An increased incident rate indicates increased awareness of emergency service responders within the CFA on the topics of hoarding and squalor. There were 24 hoarding

and/or squalor incidents identified in the CFA region of operation from April 3, 2012 to April 3, 2015. Of the 24 identified incidents, 3 resulted in death.

FINDING: The number of incidents identified is low in comparison to the MFB.

### 3.3.2 Location

The location of these incidents is relevant in identifying whether all types of suburbs are affected. The 24 incidents identified occurred primarily around the Metropolitan District and other areas of urbanization, as seen in Figure 15.

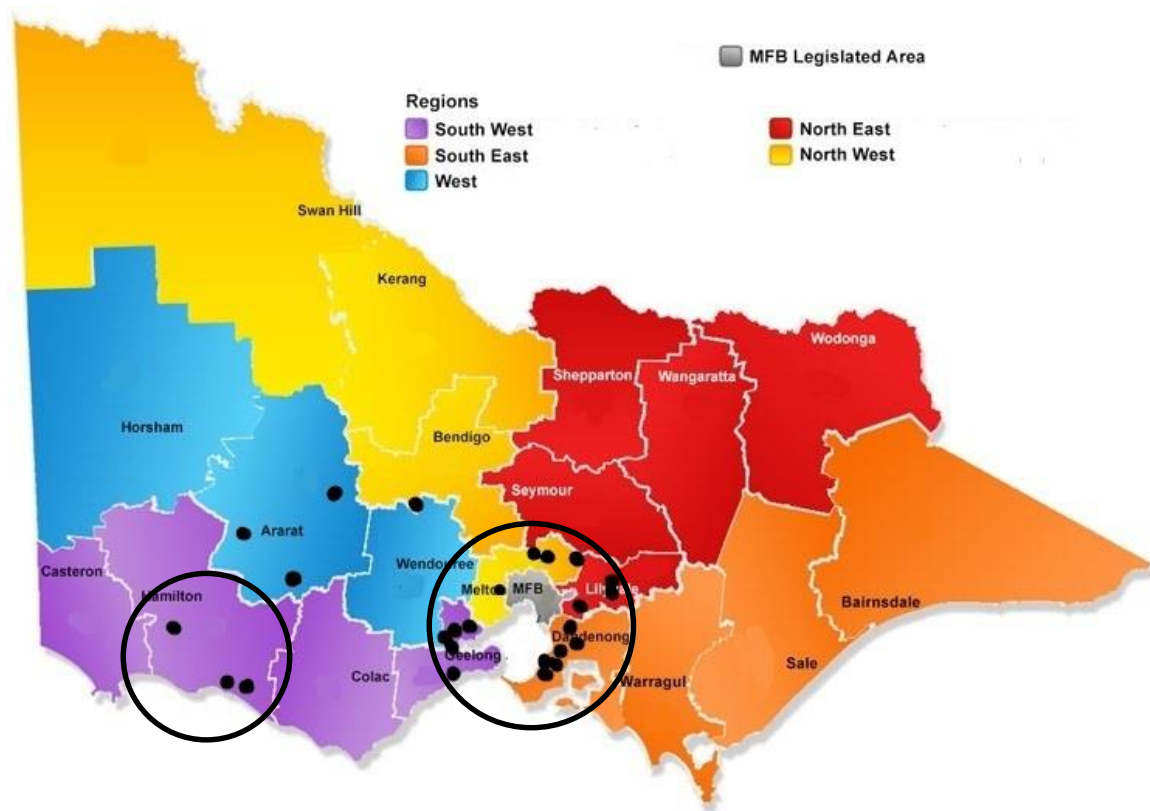


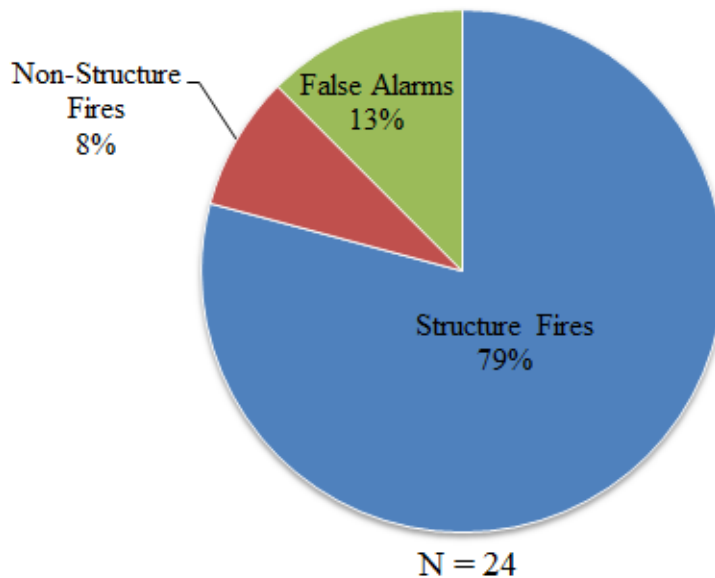
Figure 15: Distribution of CFA Hoarding and Squalor Incidents

FINDING: 80% of incidents occurred in outer urban areas and areas of growing urban/rural fringe.

### 3.3.3 Incident Type

The types of incidents were analysed to determine where individuals affected by hoarding need the most assistance from emergency service responders. As shown in Figure

16, this study has identified that of 24 hoarding and squalor incidents, 79% of them were structural fires, 8% were non-structural fires, and 13% were false alarms.



**Figure 16: Distribution of Incident Type of Hoarding and/or Squalor Related Incidents**

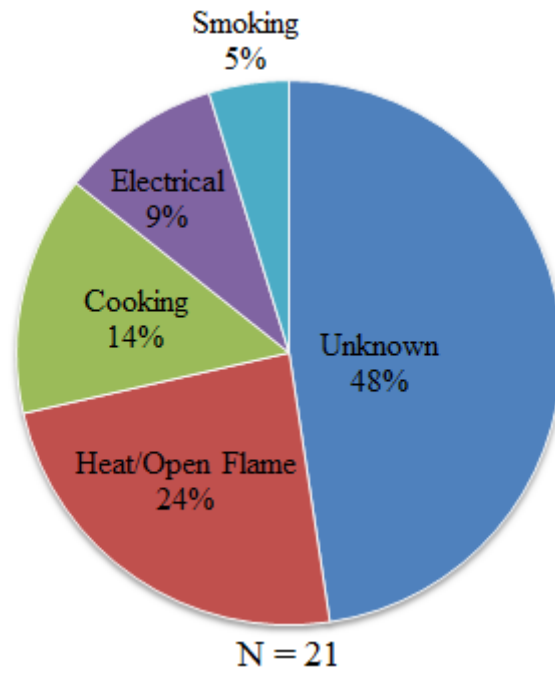
**FINDING:** Fires make up 87% of all hoarding and squalor incidents, which is consistent with the trend found within the MFB's data that the majority of incidents are structure and non-structure fires.

### **3.4 Characteristics of Hoarding Fire Incidents in the CFA Region of Responsibility**

#### **3.4.1 Cause of Structural Fire**

Of the 24 preventable residential fire incidents, 21 reported the cause of fire. As seen in Figure 17, the two most common identified causes of fire were heat/open flame (24%) and cooking (14%).



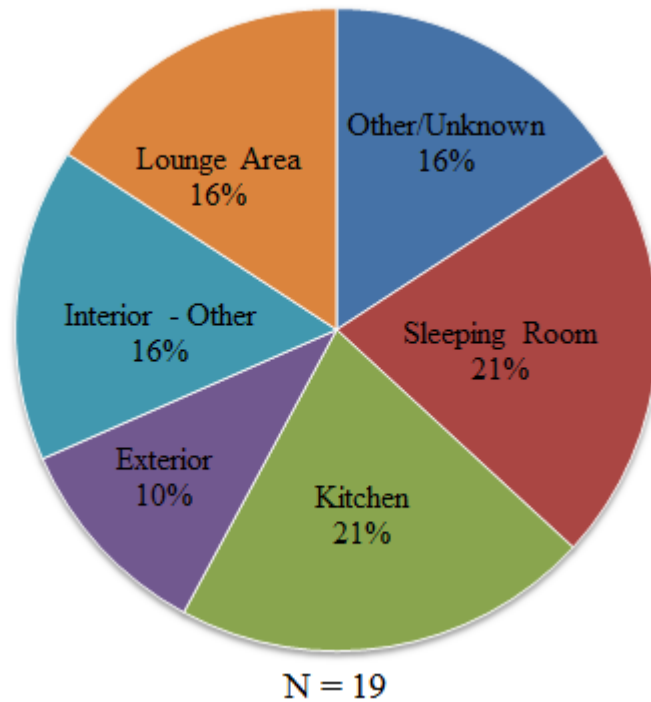


**Figure 17: Causes of Hoarding Related Fires**

FINDING: Nearly half of hoarding and squalor fires have an undetermined cause of fire, yet the most commonly identified cause of fire is parallel with the MFB's data.

### 3.4.2 Area of Origin

Of the 19 structural fires identified in this study, there is an approximately equal distribution of where the fire began, as seen in Figure 18.

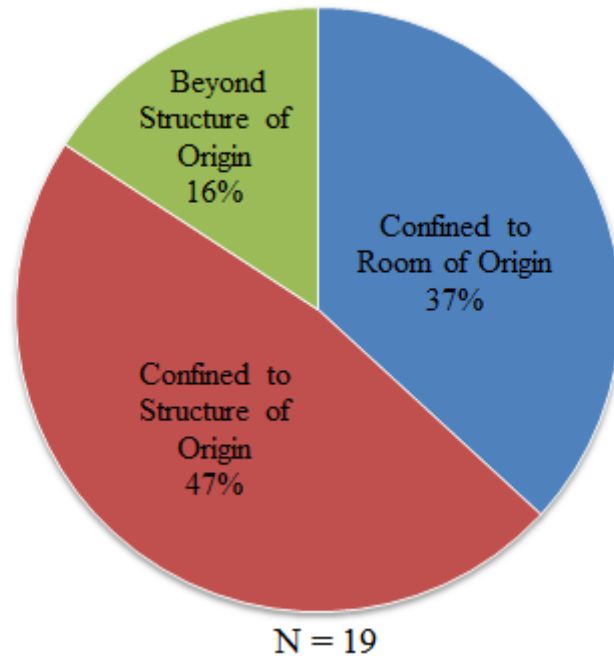


**Figure 18: Area of Origin for Hoarding Related Fires**

FINDING: This is similar to the MFB data that suggests that no area is at an increased risk of fire occurring.

### **3.4.3 Containment of Fire**

Of the 19 structural fire incidents identified in this study, 37% are confined to their room of origin, 47% are confined to the structure of origin, and 16% extend beyond the structure of origin as seen in Figure 19.

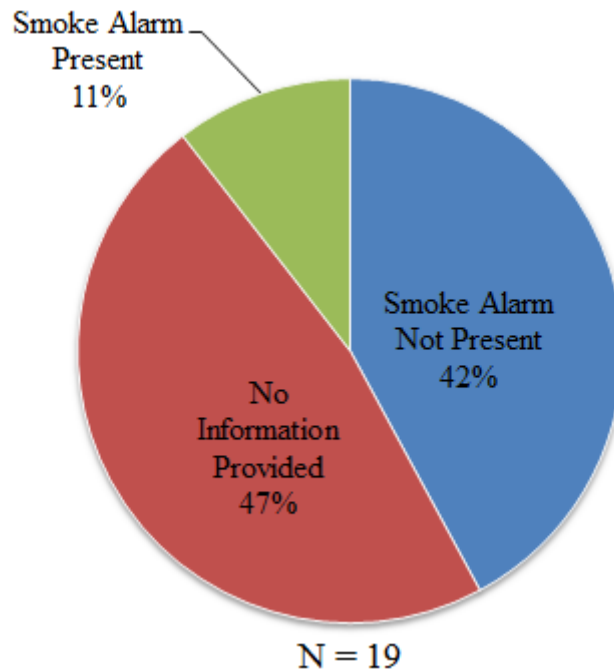


**Figure 19: Containment of Hoarding Related Fires**

FINDING: Hoarding structural fires are less often contained to the room of origin than those in the MFB.

### 3.4.4 Presence of Smoke Alarms

This study has found that of 19 hoarding fires, 11% have an operating smoke alarm, 42% have no smoke alarm present, and 47% have no information provided regarding smoke alarms, as seen in Figure 20.



**Figure 20: Presence of Smoke Alarms in Hoarding Residence**

FINDING: While just under half of the FIRS reports did not provide information regarding the presence of a smoke alarm, over half included the identification of if a smoke alarm was present. In the majority of incidents where this occurred it was no noted there was no working smoke alarm. This is consistent with MFB’s data that shows a low presence of smoke alarms in hoarding properties.

### **3.4.5 Emergency Response Incidents Involving a Deceased Person in a Home with Hoarding and/or Squalor**

Of the 24 hoarding and/or squalor incidents identified in the CFA region, 3 involved a preventable residential fire fatality.

### **3.5 Exploratory CFAST Simulations**

This exploratory analysis of various hoarding situations has uncovered characteristics of the fire dynamics involved in these types of incidents. Figures 21 and 22 show the effects in the upper gas layer temperature of the living room and kitchen. The upper gas layer, which is a mixture of volatile unburnt fuels, rises out of the fire towards the ceiling. This layer of

hot gases indicates the intensity and average temperature of the fire itself. The five simulations were plotted on one graph to compare the results of each hoarding level.

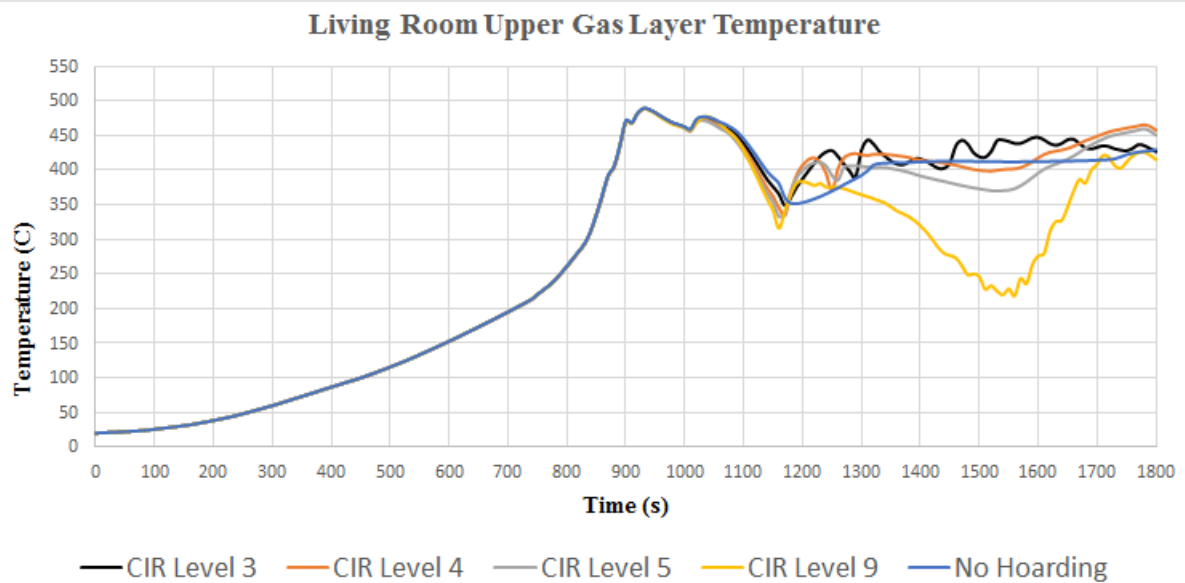


Figure 21: Living Room Upper Gas Layer Temperature

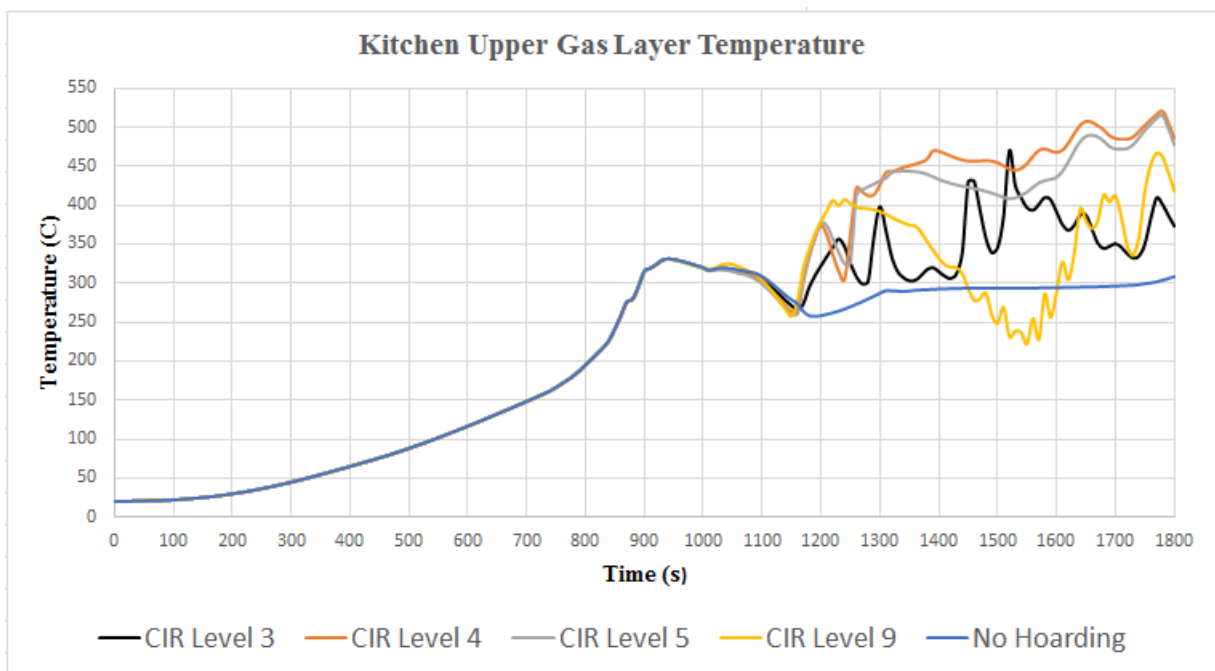


Figure 22: Kitchen Upper Gas Layer Temperature

Our findings of this exploratory simulation suggest that a CIRS level 4 and 5 results in the most severe fire environment in comparison to a normal residential fire. This

contradicts our hypothesis that a CIRS level 9 would be the most intense. The reason for this is that with a higher level of hoarding, the materials became greater and more densely packed thereby decreasing oxygen flow to the source of the fire. This resulted in a more suppressed fire. This is significant because the chances for re-ignition are greatly increased, as seen in the rise in temperature for level 9, with a slow smouldering fire as opposed to a fast spreading and intense fire. This finding suggests that in a severe hoarding fire environment, the source of any small, smouldering fires must be excavated and removed from the dwelling by firefighters to prevent later re-ignition.

From the results of this simulation, we have also found that in hoarding situations, there is a greater likelihood of fire spreading to adjacent rooms. In this simulation, we looked closely at the kitchen, which was adjoined to the living room where the fire began. When no hoarding was present, the temperature in the kitchen remained constant at 300 degrees Celsius. However, at a CIRS level 5 the temperature reached a peak of 515 Celsius, which indicates that the fire had spread. This supports our finding that hoarding fires are more difficult to contain to the room of origin than normal residential fires.

Additionally, this simulation showed that there is a significant difference between the kitchen upper gas layer temperature of a fire rated as a CIRS level 3 and a CIRS level 4. At level 4, this temperature was approximately 103 degrees Celsius greater. As the upper gas layer increases in temperature, the smoke layer descends. This makes it more difficult for firefighters to navigate through a hoarding house as there is decreased visibility. Due to this decreased visibility firefighters often crawl and bang surfaces with the back of their hands when navigating through a building. When hoarding is involved, firefighters may have to climb over top of hoarded materials which forces them into this hot upper gas layer. This finding supports the belief of the MFB that fires of level 4 on the CIRS and above are more likely to result in fire related injury or fatalities. While these simulations were run in

consultation with MFB Structural Fire Engineer, further research is necessary to support these findings.

## **Chapter 4: General Discussion**

Since 2009 when MFB developed its first hoarding fire study conducted by WPI, hoarding has emerged as a significant fire risk. Subsequent studies have included squalor incidents due to the often identified co-existence and shared risk features. With each subsequent study the reporting rate of hoarding and/or squalor incidents by MFB firefighters has significantly increased. In response to this increased rate of reporting MFB has allocated organizational resources to respond to these issues both internally and externally. These activities have included the development of risk reduction advice for affected people and support agencies, operational considerations for responding firefighters, a process through which affected properties identified through operational response can be referred, and a formalized notification system to increase operational preparedness and safety. The increased organisational understanding of hoarding and squalor and their associated risks, has worked in tandem to promote the importance of reporting these types of incidents.

Since the first study in 2009 there has also been an increase in community awareness of these issues through various television programs and news coverage about people affected by hoarding and/or squalor. Hoarding has also been recognised as a separate psychological condition, included in the Diagnostic Statistical Manual, where there is growing research on squalor and its links to capacity and cognition (American Psychiatric Association, 2013). Hoarding alone is predicted to affect between 3 to 5% of the general population and without intervention it is a chronic and progressive condition. With an ageing population, hoarding and squalor and the associated risks are likely to increase. For fire services with shared and individual competing organisational priorities and responsibilities, identifying emerging risks in the community like hoarding and squalor, is an ongoing challenge.

This study that the rate of reporting hoarding and/or squalor incidents by CFA firefighters at 86% lower than those reported in the MFB region. This low incident rate is



consistent with that uncovered by the initial hoarding study done of the Metropolitan District in 2009, in which they identified 48 fire incidents over a ten year period, approximately 4.5 hoarding incidents per year (Lucini et al, 2009). The second MFB study found that this value had increased to 20 incidents per year (Colpas et al, 2012). The current study has seen this value increase even further to 54 incidents per year. This shows that there are over 12 times more incidents per year in the MFB region of responsibility than the initial study suggested. It is important to note that the reporting rate has grown in line with broader organizational activities in relation to these issues. It cannot be determined from the current data whether this number accurately represents all incidents of hoarding within the CFA region, or if it is representative a low reporting rate of hoarding and/or squalor incidents in the CFA region.

Our findings, based on interviews with CFA representatives, suggest that not everybody is aware of what hoarding and squalor are or what risks are associated with them. Should the CFA continue to raise awareness and encourage the reporting of all hoarding and/or squalor incidents, it is likely that they will see an increasing trend in reporting. This information supports the finding that the 24 incidents reported in the CFA region are an underrepresentation of the issue.

The wide-spread location of these incidents in the MFB region of responsibility suggests that hoarding and/or squalor is not restricted to the main metropolitan area, rather it can occur throughout the state in urban, suburban, and rural areas. The presence of reported hoarding and squalor incidents in four additional local government areas over the course of this study period suggests that there is increased awareness to report these incidents across the entire MD. It also suggests that no area is immune to these incidents and that hoarding and/or squalor occurs in all areas.

In the CFA region of operation, there was a higher concentration of incidents in the outer urban areas and the urban/rural fringe. Within this area, Greater Geelong has seen an

increase in population of 10,000 between 2011 and 2014 (City of Greater Geelong, 2015). Another area with a high concentration of incidents was Dandenong. This region also had a population increase of roughly 3,000 between 2011 and 2012 (City of Greater Dandenong, 2012). In addition, a few incidents were spread throughout the Melton and Lilydale regions, which are also on the border of the MFB's boundary and are more urban areas. This data may suggest that in addition to a lower reporting rate overall that hoarding and squalor may be more likely to be reported in CFA areas with a higher population density around the MFB boundary, the urban rural fringe and the larger more highly populated regional cities in rural Victoria.

There are a variety of incident types occurring across the state regarding hoarding and squalor, however the majority of them are fire in both the MFB and CFA regions. In the MFB region of responsibility, we identified more fire incidents than the Colpas study (2012); however, the overall percentage of fires decreased by 21%. This trend may be due to the increasing levels of firefighter awareness in the MD regarding the broader safety, health and well-being issues experienced by affected people and the importance of reporting these for follow up to reduce the ongoing risks.

Studies have found that individuals over 65 years of age are at the greatest risk for fire ("Older Adults," 2014). While this study has identified these individuals as most commonly affected by hoarding and/or squalor, the number of incidents that involved 50 - 64 year olds increased by 21% since the 2012 hoarding study (Colpas et al, 2012). This may be because as more incidents are reported, there are more variables and a broader profile of individuals identified. Further research may also show that individuals aged 50 - 65 who hoard acquire the elevated fire risk of over 65 year olds prematurely due to the dangerous conditions in which they live.

This study has identified an increase in hoarding and/or squalor incidents in the MFB region of responsibility occurring in properties that share structures with neighbouring premises, such as walls, ceilings, or floors. This number has increased from 29% to 36% since the previous study (Colpas et al, 2012). This is a significant community safety issue because the close proximity of individual homes means the risk is shared by close neighbours. If a fire does occur and it spreads past the room of origin it may spread to the adjoining home as evidenced in the fire in Toronto. An abundance of hoarded items can also lead to structural damage such as the collapse of floors onto the residence living below an occupant affected by hoarding. In squalor situations, the close proximity of neighbours allows for an infestation of vermin to spread into a neighbour's residence, placing them at higher risk for illness. MFB Community Resilience has received information regarding the structural integrity of two individual apartments in the event of a fire. There are concerns regarding how much stress a building may withstand when the high fuel load and the water load required to extinguish a fire are combined. While the NSWFRS tests and our CFAST simulation showed the relations of fuel load to fire intensity and gas emissions, there has been little research based on current building standards and the stress of excessive hoarding to building structure (Rebane, 2014).

Of all hoarding fire incidents that occurred in the MD, heat/open flame, electrical, and cooking were the most common causes of fire. This result is consistent with the findings from the previous hoarding studies (Colpas et al, 2012). In the current study, heating units and sources including candle lights, bed heaters, and space heaters caused the greatest number of fires. Electrical issues were the next most common fire cause. Electrical overloads generally occurred when a large number of electrical appliances were connected to a single power board. In these cases, the high current densities cause the copper wires to heat up and ignite any insulation that is present. Electrical malfunction can occur either due to a lack of

maintenance or a defective appliance. Previous research here and overseas has identified that people who hoard are less likely to be able to maintain a safe working condition of utilities and infrastructure for a range of reasons, including an unwillingness and/or inability to provide access for repairs. This includes electricity and gas supplies and related fixed electrical appliances used for heating and cooking. Lastly, cooking fires were largely due to leaving food unattended on a stove. This is particularly risky in a hoarding household because there is typically an abundance of materials around the stove or any other heat source used for cooking. These findings were consistent with those of the CFA region of responsibility where these sources were also identified as the top three fire causes, even with a smaller sample size. In both cases, these causes of fire do not directly relate to the room of origin. This suggests that rooms are not always used for their intended purpose, which is one key characteristic of hoarding behaviour (Frost & Harlt, 1996). This information endorses MFB's current risk reduction advice for affected people and agencies that work with them. This advice is based on evidence that the usual practices related to daily living like cooking, using heating, appliances and lighting or the ad hoc arrangements to meet these needs, are more hazardous in these homes. Restoring and establishing safety and function to these areas is a priority. This is a consistent finding across the body of the research developed by MFB and conducted by WPI and should be adopted as a joint state fire services position.

In the MFB region of responsibility, this study has found that fires are contained to the room of origin 74% of the time. This containment rate of hoarding fires is 16% lower than that of normal residential fires (90%). This comparison illustrates the difficulty of containing a fire in the presence of a high fuel load. It also suggests that a fire in a hoarding household will spread and intensify more quickly than an average residential fire, putting the occupant and the firefighters at increased risk. However, it must be noted that there is an upward trend in hoarding fire containment to the room of origin which has increased by 34% since 2009

and 14% since 2012 (Colpas et al, 2012; Lucini et al, 2009). In the CFA region of responsibility, 38% of hoarding fires were contained to the room of origin, which is significantly lower than the 70% of normal residential fires that are contained. This is comparable to the finding that 40% of hoarding fires were being contained to the room of origin by the MFB at the time of the initial study (Lucini et al, 2009). This may suggest that raised awareness and understanding of the related firefighting challenges increases their preparedness more generally when responding to a hoarding fire as compared to a normal residential fire. In the event of further research on a state-wide level, it is recommended that this is examined to establish any possible link between promotion of the risk for firefighters and containment to room of origin within the CFA.

In both the MFB and CFA regions of responsibility, there are consistently low numbers of smoke alarms present in hoarding households. In the MFB region of responsibility, while 40% of residences were indicated to have a smoke alarm present, 59% of them were public/community housing properties. In public housing in Victoria it is standard procedure to install smoke alarms connected to 240 volt mains power with a 10 year long life lithium battery back-up. This means that only 17% of privately owned hoarding properties have a smoke alarm present as compared to an estimated of 86.4% (2014 Annual Report, 2014). This information confirms that affected people are less likely to install and maintain working smoke alarms. Promoting this action in addition with the other risk reduction advice may create a greater awareness among affected individuals and begin to decrease the risks posed.

The data gathered from the MFB region of responsibility has indicated that more resources are required to fight a hoarding fire than an average residential fire. In the Metropolitan District, an average of 19.4 firefighters were required in response to a hoarding fire, which is consistent with the finding of the second MFB hoarding study, whereas normal

residential fires require approximately 7.5 personnel (Colpas et al, 2012). The increased need for personnel at a hoarding fire decreases the number of resources available for other incidents that may occur at the time, and can result in overexertion and increased stress of firefighters. The increased need for resources also supports the finding that hoarding fires are more intense than normal residential fires. The increased fuel load requires a greater response effort in order to keep the fire contained and extinguish it.

As we identified eight incidents that involved a deceased person in the MFB region, one involved a preventable residential fire fatality with hoarding and squalor. This fire fatality represents 6% of all preventable residential fire fatalities in the MFB during our study period. The cause of this fire was the misuse of heat of ignition, which occurred in the kitchen. The amount of clutter appeared to be a level 6 on the CIRS, with limited access and egress for firefighters at the time of the fire. In the CFA region, three incidents involved preventable residential fire fatalities with hoarding and squalor. These fire fatalities represent 10% of all preventable residential fire fatalities in the CFA during our study period. Of these three incidents, only one incident was contained to the room of origin, while the other two incidents extended beyond the structure of origin. On the CIRS, a level 7 was present throughout each incident. The supports that a level 5 and above on the CIRS increases the chances of a fire fatality.

## Chapter Five: Recommendations and Conclusions

Based on our results and findings, we propose the following recommendations to the MFB and CFA.

**Recommendation One:** That the MFB and CFA meet to review and discuss the findings of this first state-wide hoarding and squalor study. It is recommended that Operations is represented in addition to Community Resilience to ensure an “all of organisation” approach to the discussions.

**Recommendation Two:** That the MFB and CFA Community Resilience Departments adopt a joint policy position in relation to hoarding, squalor and risk to build consistent state-wide fire services practice.

**Recommendation Three:** That joint information is endorsed and adopted by fire services state-wide in relation to:

- Affected people, their families and the agencies which support them. The results of this study support the current advice available on the MFB website but it is recommended that this is reviewed to reinforce the need for additional smoke alarms in affected properties. Also that the advice is available on MFB and CFA websites.
- Firefighters. The results of this study confirm that firefighters continue to respond to a growing number of emergency incidents in which hoarding and squalor are present. While MFB has developed a package of information such as the hoarding information in the Emergency Response Guidebook and a hoarding presentation is currently delivered to Operational Firefighters, we recommend this be reviewed to ensure it is deliverable across both fire services. In addition to definitions of hoarding and squalor and the associated risks, the information should include operational

considerations and the importance of reporting incidents. It is strongly recommended that this is initially rolled out to CFA areas which share a boundary with MFB and their outer urban areas and large rural cities.

**Recommendation Four:** That the MFB and CFA Community Resilience Departments scope the possibility of implementing the Hoarding Notification System developed by MFB into the CFA region of responsibility. This would promote consistent practice and ensure that CFA firefighters, both permanent and volunteer, were provided with the same alert to increase their preparedness and safety as MFB firefighters.

**Recommendation Five:** That research continues to be developed in relation to:

- Hoarding and squalor incidents in Victoria to build on this research study and continue the state-wide profile of these issues. This would provide an opportunity to determine if the CFA rate of reporting incidents in this report is accurate or more reflective of MFB's reporting rate in the first study when awareness of firefighters was lower. We suggest a time frame that will allow enough time for reporting trends to emerge and allow for a consistent comparison with previous studies. We believe that a major focus of this study should be the effect of urban sprawl on the presence of hoarding and squalor in the CFA area, as this could inform urbanizing areas around the world.
- The fire dynamics of hoarding fires in comparison with other residential fires. This will provide a scientific basis upon which to analyse risks in hoarding fire scenarios. While our CFAST simulation provided a glimpse into the effects of hoarding on upper and lower gas layer temperature, we believe that a more in depth comparison could be of valuable use to the fire services.



- The performance of buildings in relation to the long term stress loads caused by hoarding on a structure. This should also include the additional effects of the water required to extinguish a fire in a hoarding residence and its effect on different types of residential structures.

## **Conclusion**

Hoarding and squalor are complex and growing issues which are high risk and present dangers to affected individuals, their neighbours and all emergency responders when an incident occurs. For fire services these risks are increased due to the additional challenges resulting from a high fuel load, the increased need for search and rescue and a complex range of hazards which are not often identifiable when arriving at the scene of a residential emergency. In addition to these risks, affected people are unlikely to reduce the range of safety, health and wellbeing issues without appropriate support or interventions. This requires an increased awareness and understanding by all stakeholders to develop a consistent level of knowledge and practice based on interagency approaches which can respond to deliver improved safety outcomes.

## References

- 2014 Annual Report. (2014, January 1). Retrieved May 2, 2015.
- American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental
- Babrauskas, Dr. D. Glass Breakage in Fires. Retrieved April 26, 2015
- Banerjee, S., Halliday, G., & Snowden, J. (2012). *Severe Domestic Squalor*.
- Brown, W., & Zsuzsa, M. (2007). Hoarding. *Psychiatric Times*.
- Catholic Community Services (2014). Pathways to Dealing Effectively with Hoarding & Squalor in Australia. Retrieved April 20, 2015.
- CFOA. (2015, May 2). Facts and Figures about Hoarding. Retrieved May 2, 2015.
- Chief Fire Officers Association (2011). Lewisham Borough Council and London Fire Brigade collaborative working – a case study. Retrieved January 25, 2015.
- Colorado State University. (2008, June 20). Human Health Impacts. Retrieved January 27, 2015.
- Colpas, E. ,De Zulueta, J. , Pappas, D. (2012). An Analysis of Hoarding Fire Incidents and MFB Organisational Response.
- Commonwealth of Victoria. (2014, March 1). Emergency Management. Retrieved May 2, 2015.
- Country Fire Authority. (n.d.). Retrieved January 26, 2015.
- Dassanayake, D. (2015, January 16). Hoarder, 66, crushed to death by clutter after floor collapse. Retrieved April 20, 2015.
- Disorders, Fifth Edition. Arlington, VA: American Psychiatric Association.
- Donnelly, K., Neziroglu, F., Slavin J. (n.d.). How Compulsive Hoarding Affects Families.
- Fire Death Rate Trends: An International Perspective. (2011, July 1). Retrieved May 2, 2015.
- Frost, R., Grisham, J., Steketee G. (2003). Measurement of Compulsive Hoarding: Saving Inventory - revised.
- Frost, R. O., Green, K. A. I., & Steketee, G. (2003). Measurement of Compulsive Hoarding: Saving Inventory - revised. *Brief Treatment and Crisis Intervention*.
- Frost, R. O., Hartl, T. (1996). A cognitive-behavioral model of compulsive hoarding. *Behaviour Research and Therapy*
- Haddam Volunteer Fire Company. (2013). What's it weight? Firefighter gear, piece by piece. *Killingworth Patch*.
- Hoarding and DSM-5. (2012, October 24). Retrieved May 2, 2015.
- Hoarding and fire safety. (n.d.). Retrieved January 22, 2015.
- Hoarding Notification System. (n.d.). *MFB*.

- Hoarding of Animals Research Consortium (HARC). (2010, January 1). Animal Hoarding and Public Health. Retrieved February 1, 2015.
- Homchenko, M., Lackie, J., Morse, B. (2014). An Analysis of Hoarding and Squalor Related Incidents and Responses by the Metropolitan Fire and Emergency Services Board.
- 'Human hamster' Hoarder's body found buried in 'nest' of rubbish 8 months after his death. (2015, January 30). Retrieved April 20, 2015.
- London Fire Brigade. (n.d.). Retrieved January 20, 2015)
- Lucini, G., Monk, I., & Szlatenyi C. (2009). An Analysis of Fire Incidents Involving Hoarding Households.
- Macfarlane, S. (2013). Neuropsychology of Squalor.
- Mental Health Association of San Francisco. (2007). San Francisco Task Force on Compulsive Hoarding. *Beyond Overwhelmed*.
- MFB Annual Report 2013 - 2014. (2014, January 1). Retrieved May 2, 2015.
- Mordecai, M. (2008). Watching out for overexertion before it's too late.
- National Pest Management Association. (n.d.). How Pests and Rodents Can Affect Your Health. Retrieved January 24, 2015.
- New South Wales Government. (2012, October 16). Domestic Squalor. Retrieved January 23, 2015.
- Pearson, E. (2014, October 22). Up to 11,000 hoarders in our region. Retrieved January 22, 2015.
- Pennington, R. (2014, July 23). THE DANGERS OF HOARDER FIRES. Retrieved January 22, 2015.
- Raven, D. (2015, April 7). Woman's mummified body 'buried under rubbish' next to 300 bottles of urine. Retrieved April 20, 2015.
- Rebane, Melanie (2014, July). Research Tests: Hoarding Fire Behavior. Retrieved January 26, 2015.
- Schorow, S. (2012). The Dangers of Too Much Stuff. *NFPA Journal*.
- Stepping Towards Solutions to Resolve Incidents of Severe Domestic Squalor in South Australia. (2013). *A Foot in the Door*.
- Tenure. 2011. In *thefreedictionary.com*.
- Tolin, D., Frost, R., & Steketee, G. (2008, December 2). The Hoarding Rating Scale - Interview. *Psychiatry Research*. Retrieved January 17, 2015.
- U.S. Army Center for Health Promotion and Preventive Medicine. (2004). Fecal Matter in the Air - What do we know?
- Victoria Department of Health. (2012). *Discussion Paper Hoarding and Squalor 2012 Ageing and Aged Care Branch*. Victoria, Australia: Victorian Government

Victoria Department of Health. (2013). *Hoarding and Squalor A Practical Resource for Service Providers*. Melbourne, Victoria, Australia: Victorian Government.

Whitfield, K., Daniels, J., Flesaker, K., & Simmons, D. (2011). Older Adults with Hoarding Behaviour Aging in Place: Looking to a Collaborative Community-Based Planning Approach for Solutions. *Journal of Aging Research*, 1-8.

Wilson, E. (2008). How Compulsive Hoarding Can Threaten Your Health and Take Over Your Life.

Yang, Y., & Raine, A. (2009). Prefrontal Structural And Functional Brain Imaging Findings In Antisocial, Violent, And Psychopathic Individuals: A Meta-analysis. *Psychiatry Research: Neuroimaging*

## Appendices

### Appendix A: Turn Out Gear



## Appendix B: Blank AIRS Report

**Primary Report Header**

Zone/Call No	Station No	Station Name	Platoon	ESTA Type	Status
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Call Received	Station Dispatched	Word-Back	Duties Completed	Response Code	Delay
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
No	Street Name	Town / Suburb	Postcode	Municipality	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Map Ref - MGA	Jurisdiction	Occupants Name			
Zone <input type="text"/> E <input type="text"/> N <input type="text"/>	<input type="text"/>	<input type="text"/>			
How Call Detected	How Call Reported				
<input type="text"/>	<input type="text"/>				
Type Of Occupant	Type Of Owner	Mutual Aid			
<input type="text"/>	<input type="text"/>	<input type="text"/>			
General Property Use					
<input type="text"/>					
Fixed Property Use					
<input type="text"/>					
Incident Type					
<input type="text"/>					
Action Taken					
<input type="text"/>					
Problems Encountered					
<input type="text"/>					
Weather					
<input type="text"/>					
Peak: Personnel At Scene	Pumpers	Aerials	Aircraft	Special Vehicles	Other Vehicles
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Salvage: Performed	Authorised	Commenced	Completed	BA Sets	
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
		00/00/0000 00:00	00/00/0000 00:00		

**Casualties / Rescue / Evacuation (Block D)**

No of Civilians Injured	No of Civilian Fatalities	No of Brigade Persons Injured	No of Brigade Fatalities
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
No of Persons Extricated	No of Persons Released	No of Persons Assisted by Brigade	Total No of Persons Involved
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
No of Post Event Fatalities			
<input type="text"/>			
No of Persons Rescued			
<input type="text"/>			
Authority Affecting Rescue			
<input type="text"/>			
Rescue Type			
<input type="text"/>			
No of Persons Evacuated	Time/Date Evacuation Commenced	Time/Date Evacuation Completed	
<input type="text"/>	00:00:00 00/00/0000	00:00:00 00/00/0000	
Authority Affecting Evacuation			
<input type="text"/>			
Evacuation Problems			
<input type="text"/>			
Notes			
<input type="text"/>			
Created By	Created Datetime	Last Modified By	Last Modified
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Ignition (Block E)**

Area Of Origin

Occupant of Ignition Area

Activity in Ignition Area

Form of the Heat of Ignition

Ignition Factor

Type of Material Ignited First

Form of Material Ignited First

Equipment Involved in Ignition

Year of

Manufacture Make



Model

Serial No

Voltage

Created By

Created Datetime

Last Modified By

Last Modified

**Structure Fires (Block K)**

Time/Date of Extinguishment

Structure Type

Construction Type

Building Dimensions

m<sup>2</sup>

Number of Levels

Wall Linings

Ceiling Linings

Level of Fire Origin

Building Code Class

Type of Material Contributing Most to Fire Intensity

Form of Material Contributing Most to Fire Intensity

Type of Material Generating Most Smoke

Form of Material Generating Most Smoke

Factor Contributing to Flame Spread

Avenue of Smoke Travel

Extent of Smoke and Heat Damage

Extent of Flame Damage

Extent of Extinguishing Medium Damage

% Property Saved

Smoke Alarms/Detectors Fitted

Detector Location In Relation to Fire

Detector Power Supply

Detector Operation

Detector Effectiveness

Detector Failure

Suppression/Air Handling Equipment Fitted

Sprinkler Performance

Factors Degrading Sprinkler Effectiveness

No Of Heads

Air Handling System Performance

Extinguishers Installed

No Used

Hose Reels Installed

No Used

Hydrants Installed

No Used

## Appendix C: Key Words

*Aces*	Cans	Filled with
*bric-	Chattel	Filth
*bric*-	Closed off	Fire load
*bric*a	Cluter	Food scrap
*brica	Clutter	Foul
*brick-	Clutter image rating scale	Fuel load
*brick*-	Collection	Full of items
Brick*a*	Community Care	Garbage
*bricka	Community care	Goods
*brik*	Cotents	Grime
Abnormal	Debris	Hampered
Abundance	Decay	Haord
Access+Hard OR difficult OR poor OR "no access" OR lack	Decompos	Heavily loaded
Accumulat	Defication	High level of
Access	Dementia	Hoar
Acrid	Deny help	Hord
Ad hoc	Depravity	Hored
Amount+significant OR large OR excess OR huge OR enormous	Dingy	Hovel
Anormal	Dirt	Hygene
Bad electrical wiring	Discarded	Hygiene
Blocked	Disgusting	Impede
Blocking	Egress+Hard OR +difficult OR +poor	Impede
Boxes	Encroach	Insects
Breach of	Excess	Jnk
	Faeces	Julie Harris
	Feces	Junk
		Lack of maintenance



Limited	Rotting	Strewn
Lined	Rubbish – “rubbish truck” – “chute” – “rubbish bin” – “small rubbish fire” – “bin of rubbish” – “small amount of rubbish” – “bins of rubbish”	Unable to organise
Local council		Unable to organize
Many animals		Unclean
Memorabilia		Unhygienic
Mental health		Unkept
Messy	Rubish	Unorthodox
Mice	Ruvbbish	Unsanitary
Mold	Shabby	Untidy
Mould	Sickening	Urine
Much	Small Path	Vermin
Multitude	Smelly	Volume of items
Narrow	Smelt	Volume of Materials
Neglect	Soiled	Wreched
Notification pack	Spoiled food	
Organic matter	Spoilt	
Pile	Sqalor	
Poor	Squalid	
Pungent	Squallid	
Putrid	Squalor	
Rat infested	Squalour	
Rat-infested	Stack	
Rats	Stink	
Refer	Stock	
Refuse	Storage items	
Resistance	Stored	
Rotten	Storred	

## **Appendix D: Incident Detail Categories**

### ***Age of Occupant***

Classified as one of three categories:

- Under 55
- 55 – 65
- Over 65

### ***Incident Type***

Classified as one of five categories:

- Residential Structure Fire
- Non-Structure Fire
- Emergency Medical Response
- False Alarms
- Other Incidents (Includes Lock Ins, Lock Outs, Chemical Hazards, etc.)

### ***Property Type***

Classified as one of three categories:

- Apartment/Flat (Includes Units and Semi-Detached)
- House
- Other

### ***Property Tenure***

Classified as one of three categories:

- Owner-occupied
- Private Rental
- Public/Community Housing

### ***Cause of Fire***

Classified as one of five categories:

- Heat/Open Flame
- Cooking
- Electrical
- Smoking
- Undetermined

### ***Room of Origin***

Classified as one of six categories:

- Kitchen
- Exterior (Includes lawn, yard, decks, and terrace)
- Interior-Other (Includes bathrooms, foyers, dining rooms, and laundry rooms)
- Lounge Area

- Unknown
- Sleeping Room

### ***Containment Status***

Classified as one of three categories:

- Confined to Room of Origin
- Confined to Structure of Origin
- Extended Beyond Structure of Origin

### ***Presence of Smoke Alarm***

Classified as one of three categories:

- Operational Smoke Alarm Present
- Operational Smoke Alarm Not Present
- No Information Provided

### ***Total Number of Personnel***

Classified as one of six categories:

- 1 – 10 personnel
- 11 – 20 personnel
- 21 – 30 personnel
- 31 – 40 personnel
- 41 – 50 personnel
- 50+ personnel

## **Appendix E: Additional MFB Findings**

### **Gender**

**FINDING:** A majority of hoarding and/or squalor incidents involve males.

Of all incidents that the MFB responded to during this study period, 126 of them specified the gender of the occupant. Of these incidents, 59% involved males and 41% involved females. These results are similar to those of the 2012 hoarding study, which found an equal distribution of male and female occupants amongst hoarding and squalor incidents (Colpas et al, 2012).

### **Season**

**FINDING:** Hoarding and squalor incidents are evenly distributed across all four seasons.

The season in which all hoarding and squalor incidents occurred was analyzed to identify a time of year when these incidents may be more prevalent. It was found that there is an equal distribution of events across all four seasons. This information suggests that there is no link between hoarding and squalor and season.

### **Time of Day**

**FINDING:** A majority of hoarding and/or squalor incidents occur in the evening.

The time of day in which a hoarding and/or squalor occurred was analysed in order to identify any possible trends as to when an incident may be most likely to occur. For the purpose of this study, day time was defined as 7 AM to 2 PM, evening was defined as 2 PM to 11 PM, and late night was defined as 11 PM to 7 AM. These time-frames were chosen in order to be consistent with those used by previous study groups (Colpas et al, 2012). Our findings show that 43% of all hoarding and/or squalor incidents occurred in the evening and 35% occurred during the day time. This may indicate the times at which the occupants of hoarding households are most active throughout their home. This finding supports that of the 2012 hoarding study (Colpas et al, 2012).

### **Alarm Level**

FINDING: 80% of all hoarding incidents related to fire were first alarm.

There are different types of alarm levels for structure fires. Alarm levels are determined by the number of appliances and personnel on scene to combat a fire incident. This is a way to examine the severity of the fire by the MFB. First alarm, which is the lowest level, requires two pumpers and if necessary a third pumper. Second alarm requires four pumpers, one teleboom, one rescue unit and one commander. Third alarm requires eight pumpers, one teleboom, one rescue unit, one ladder platform, one breathing apparatus unit, one control unit, three commanders, and one duty officer (Homchenko et al, 2014).

Of all hoarding and/or squalor incidents related to fire, 80% were first alarm and 20% were second alarm. This is consistent with the findings of previous hoarding studies where majority of the fires were first alarm (Colpas et al, 2012). In these cases, the incident controller can request additional resources at the scene, depending on the severity of the fire, without raising the alarm level.

### **Total Number of Appliances and Total Number of Pumpers**

FINDING: 41% of hoarding fires required more than three appliances.

Another method of gauging the severity of a fire situation is through the total number of appliances and pumpers that attend. The total number of appliances is a measure of the total resources that were required to extinguish the fire and control the scene. The pumper is the main fire-fighting appliance that attends a fire, and the number of these present is most directly relatable to the severity of the fire. Our findings show that 59% of hoarding fires require 1-3 appliances total and 58% require 2 or fewer pumpers, which is the number automatically dispatched to all residential fires in the Metropolitan District. These numbers are consistent with those found by the 2012 hoarding study (Colpas et al, 2012).

### **Estimated Structural Dollar Loss**

**FINDING:** Nearly half of hoarding related fires had an estimated structural dollar loss of more than \$10,000.

Estimated structural dollar loss is a way to quantify the structural damage of a property, as well as gauge the severity of a fire. This value is reported in AIRS as an estimation made by the Incident Controller at the scene. This does not include the estimated dollar loss for damaged contents within the structure.

Of the 72 identified hoarding squalor related structure fires, 35 had a dollar loss of \$10,000 or more (49%). Across all fires, the estimated structural dollar loss ranged from no loss at all (15%) to more than \$500,000 in one case. Estimated structural dollar loss has not changed significantly from the previous hoarding studies with a majority of hoarding related fires having

## **Appendix F: Additional CFA Findings**

### **Property Type**

Of 21 incidents that specified property type, identified in the CFA region, 95% of hoarding and squalor incidents occurred in stand-alone houses and 5% occurred in apartments/flats. This does not correspond with the findings of the MFB region, however the sample size is too small to draw any conclusions as to why.

### **Total Number of Personnel**

Of 19 fire incidents identified in the CFA region of responsibility, 52% required between 11 and 25 personnel and 48% required less than 10 personnel. Due to the small sample size it is difficult to draw any conclusions from this data.