ASSESSING EMERGENCY RESPONSE MECHANISMS TO INFORMAL SETTLEMENT FIRES IN CAPE TOWN

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DECLARATION

I hereby declare that this work submitted in fulfilment of the requirements for a Masters' Degree in Disaster Management at the Disaster Management Training and Education Centre for Africa (DiMTEC), is in all honesty solely mine and, where that is not true as in all academic endeavour, sources of borrowed knowledge are appropriately acknowledged.

Signature Date

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To my beautiful wife, Erin Pienaar, thank you for your patience, constant encouragement and always praying for me.

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DEDICATION

I dedicate this dissertation to my wife, Erin Mellissa Pienaar and to my sons, Jonah Aaron and Jesse Asher Pienaar, for their undying love and support.

ABSTRACT

Rapid urbanisation in South Africa results in the influx of people from rural areas to urban areas. This leads to a shortage of accommodation as well as resources. In the end, people live in marginalised areas. One of Cape Town's worst informal settlement fire occurred on 29 November 2015. The fire in Fishoek's informal settlement, Masiphumelele, destroyed 800 structures, consequently displacing 4000 people. This led to the need for the implementation of an effective emergency response plan.

The results show that the fire affected the entire population of Masiphumelele either directly or indirectly. Some were affected directly by loss of property while some were affected by having to carry the burden of taking care of the affected families. Trauma and uncertainty gripped the whole community in the aftermath of the fire. The majority of the respondents were male (72, 5 %), most of whom were unemployed at the time of the study. The majority of the respondents were between the ages of 26- 45 years for both men and women. Most respondents had acquired secondary school education at the time of the interview.

Through interviews, it was established that most respondents had resided in Masiphumelele for over 5 years, as independent families or being looked after by other families. Property owners in the informal settlement built additional structures and rented them out to other families for extra money, despite that it was already an overcrowded community. This attributed to many illegal electrical connections that were noted at the time of the study. Despite the legal electrical connections, people still preferred using other forms of heat energy, which contributed to the disaster. The structures built were of low quality, built from combustible materials.

The community of Masiphumelele was not prepared for this disaster. The residents lacked knowledge about fire response or disaster response in general. Fortunately, fire responders were prepared for the disaster. Support was received from other organisations that stepped in with resources afterwards or during the disaster.

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ABBREVIATIONS AND ACRONYMS

HDA	Housing development agency
DPLG	Department of Provincial and Local Government
DWAF	Department of Water Affairs and Forestry
UN	United Nations
PAR	Pressure and Release
FEMA	Federal Emergency Management Agency
ICS	Incident Command System
IAP	Incident Action Plan
UNISDR	United Nations International Strategy for Disaster Risk Reduction
NEMA	National Emergency Management of Nigeria
SAPS	South African Police Service
IFRC	International Federation of Red Cross and Red Cross Society
NIMS	National Incident Management System
SANS	South African National Standard
NFPA	National Fire Protection Association
ESS	Emergency Service System
CAD	Computer Aided Design
IMS	Incident Management System
AIIMS	Australian Inter-Service Incident Management System
EAS	Emergency Alert System
NGO	Non-Governmental Organisation
NDMC	National Disaster Management Centre
WOF	Working on Fire

DEFINITION OF TERMS AND CONCEPTS

Informal settlements are areas where groups of housing units have been constructed on land that the occupants have no legal claim to or occupy illegally; unplanned settlements and areas where housing is not in compliance with current planning and building regulations (Moyer and Solano, 2016).

Emergency response is the effort by public safety personnel and citizens to mitigate the impact of an incident on human life and property (Merriam-Webster Dictionary, 2018).

Vulnerability assessment is the process of identifying, quantifying and prioritising the vulnerabilities in a system. Systems for which vulnerability assessments are performed include, but are not limited to, information technology systems, energy supply systems, water supply systems, transportation systems, and communication systems (Merriam-Webster Dictionary, 2020).

Incident command system (ICS) This system was first developed to provide a command structure to manage massive wildfires in the United States, now widely used by many emergency management agencies. It is designed to keep order and to follow a sequence of set guidelines (Rimstad *et al.*, 2014).

Incident action plan (IAP) An Incident Action Plan is a strategic and tactical plan developed by the incident commander (Rimstad *et al.*, 2014).

Chain of command is a common fire service term that means to work through one's direct supervisor. The fire service is viewed as a paramilitary organisation, and because of this, all requests for information outside the assigned workplace should go through the supervisor (Rimstad *et al.*, 2014).

Unity of command is ensuring the unity of effort under one responsible person (or commander) for completing a task (Rimstad *et al.*, 2014).

The unified command is the structure used to manage an incident involving multiple response agencies or when multiple jurisdictions have responsibility to control an incident (Rimstad *et al.*, 2014).

Span of control is the ability of one individual to supervise several other people or units. The normal range is three to seven units or individuals, with five units being the ideal (Rimstad *et al.*, 2014).

Incident management system (IMS) is a system designed to assist in the management and command of emergency operations such as natural disasters, civil disturbances, multiple casualty incidents, hazardous materials incidents, fires and acts of terrorism. The critical components of the system include finance, logistics, operations, and planning (Rimstad *et al.*, 2014).

Incident commander is the officer in charge of all activities after an incident (Rimstad *et al.*, 2014)

CHAPTER ONE: BACKGROUND AND MOTIVATION OF STUDY

1.1 Introduction

Informal settlement fires in Cape Town highlights the need for development and effective emergency response (Rosenberg, 2013). One of Cape Town's worst informal settlement fires occurred on November 29, 2015, in Fishoek's informal settlement, Masiphumelele. The fire destroyed 800 structures, leaving 4000 people displaced on 29 November 2015 (Konyana, 2015). These informal settlement structures are built close to each other with combustible materials such as wood, cardboard, and light metals making it easy for fires to spread rapidly.

South Africa has the second largest economy in Africa (Abrahams, 2016), and is ranked the 67th largest economy in the world (Redl, 2018). It has a population of 58 million, of which 63% lives in urban areas, and is one of the most urbanised country in Southern Africa (Güneralp, Güneralp and Liu, 2017). The population continues to grow mostly through internal migration and immigration (Flahaux and De Haas, 2016).

Both types of migration are a consequence of economic exploitation, political and civil tension, or environmental disasters (Dadush and Niebuhr, 2016). For example, rapid urbanisation in South Africa due to job search has resulted in the influx of people into major cities, creating a shortage of accommodation, forcing people to live in congested, marginalised informal settlements such as Masiphumelele, where there are no essential services and there is no spatial development planning (Marutlulle, 2017). The slogan of the City of Cape Town's Municipality's is *'The City that works for you'*, meaning The City works for its people and is responsible for the safety and basic needs of all its inhabitants. By providing public hospitals, municipal roads, electricity, regulating abattoirs, street lighting, city police services, health services, emergency services and environmental services, the city endeavours to provide excellent services to its inhabitants irrespective of their social-economic status (City of Cape Town, 2019).

Among the services provided by the municipality are fire brigade services. The Fire Brigade Service Act (1987) states that it is the responsibility of the municipality's fire department to respond and manage any fire-related incidents like informal

settlement fires. Other responsibilities include response to hazardous material incidents, medical services, and a variety of rescue missions. +Collaboration is required between agencies such as Disaster Management, South African Police, and Ambulance services, to mitigate disasters (Department Provincial and Local Government (DPLG) - South Africa, 1998).

Chapter 5 of the Disaster Management Act (Act 57 of 2002), as amended (Act No. 16 of 2015 Disaster Management Amendment Act, 2015) outlines a framework for different municipal entities for emergency response. The Incident Command System (ICS) guides multiple agencies to coordinate their efforts to reach incident objectives and to manage the emergency, that is, to extinguish the fire, to rescue people, to evacuate and rehabilitate the community (Jensen and Thompson, 2016).

1.2 Background of the study area

Masiphumelele, also known as Site 5, is an informal settlement just outside Cape Town with approximately 38 000 people who migrated from rural areas across South Africa to Cape Town. Housing structures in the area are built with unconventional building materials, which results in a high fire hazard. People live in crowded conditions in shacks made of corrugated iron and wood[1]. The land is limited, and structures are built close to each other, which can result in rapid-fire spread (Govender, Barnes and Pieper, 2011). For example, the distance to the first nearest neighbour in Masiphumelele peaks at <0.5 m, the second nearest neighbour peaks at just less than 1 m, and the third nearest neighbour peaks at around 1.5 m^2. The area has a high unemployment rate, and the continuous influx of newcomers, looking for jobs, puts stress on already limited resources (Western Cape, 2021). Figure 1.2.1 and 1.2.2 shows the location of Masiphumelele in relation to other areas.

[1] https://www.eifl.net/system/files/resources/201408/masiphumelele_community_library_hires.pdf
[2] https://publichealth.jmir.org/2020/2/e18844/

Figure 1.2.1: Fishoek fire station's designated area
Google Maps (2018)

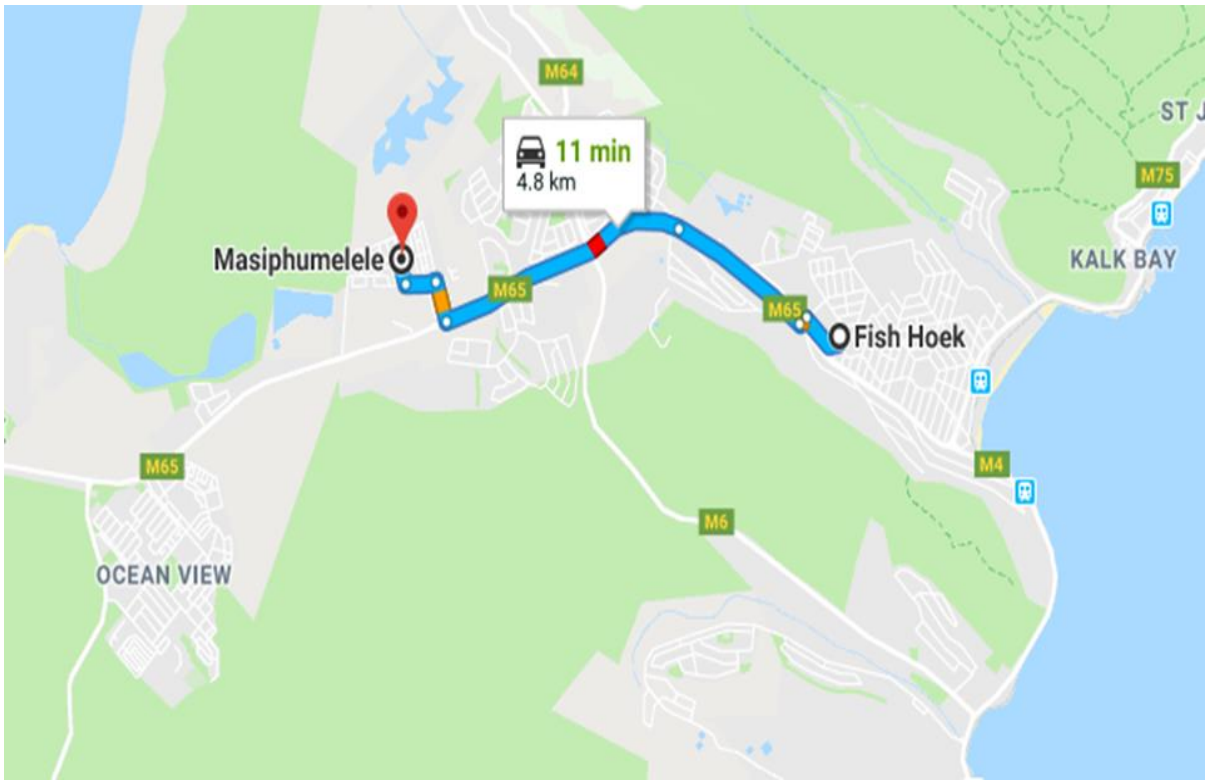

Figure 1.2.2: Distance from Fishoek fire station to Masiphumelele
Google Maps (2018)

In the early 1980's a group of 400-500 black people started the first informal settlement close to where Masiphumelele is today, in the bushes around that area where the huge Long beach shopping mall is located today. Under apartheid laws, these families were repeatedly chased away. Later they were told that this area was for black people only to work, but they had to live in the poorly set up township of Khayelitsha, more than 30 kilometres away. Those people who had found some work in the Fishoek area tried severally to move back to their former homes without success[3]. Over the years, Masiphumelele has grown to be a recognised informal settlement which continues to be overcrowded and have multiple fire outbreaks due to several reasons stated in subsequent sections. Within the City of Cape Town Municipality's boundaries, more than one hundred people die each year due to shack fires (City of Cape Town, 2013). In this case under study, two people died, and four thousand were left homeless in a fire that destroyed eight hundred shacks on November 29, 2015. The blaze started after midnight and took sixty-five emergency workers with fourteen fire tenders to control the fire by mid-Sunday morning (Konyana, 2015).

Victims of the blaze marched to the Fishoek municipal offices and handed a memorandum demanding land to rebuild their structures. About 10 families who lost their homes were given building materials, but they had nowhere to rebuild their structures due to unavailability of land. As a result, they built illegal structures on land which belongs to South African National Parks, which were eventually demolished (Ntongana, 2017).

According to residents' claims, the City of Cape Town fire department took more than one hour to arrive at the scene, despite it being 4, 8 kilometres away. The Fire Report states that the fire department responded as soon as they received the emergency call (Appendix 4). When the fire fighters eventually arrived, there were already more than one hundred shacks alight, and the first truck that arrived could not get close enough to make a difference. More trucks arrived, and residents assisted in slowing down the inferno by using buckets and water drawn from taps (Ntongana, 2017).

[3] https://hokisa.co.za/about/history-of-masiphumelele/

Rapid emergency response is vital in reducing the impact of shack fires. If the initial response is adequate, then recovery and rehabilitation are achievable. The emergency response needs to be initiated timely to avoid the occurrence of more damage.

1.3 Motivation of the study

The media coverage on informal settlement fires and reported community complaints of late first response motivated this study. In most communities, the fire department is usually the first to respond to any emergency or disaster (Kramer, 2009). The fire department is expected to respond quickly, with little information and understanding of the emergency. Media coverage shows that the fire service is always involved in delivering disaster control.

The role of fire fighters as first responders to the City's informal settlement fires, made it vital to evaluate their emergency response as well as their resources. Active response and minimal damage entail community members calling for help during an emergency. It was therefore also necessary to evaluate how the community can initiate response mechanisms (Fire Service Manual, 2003). A witness or early detection system initiates the emergency response. Thus, when someone sees a fire, the individual contacts the fire department. Emergency response, in this case, is dependent on the first phone call made to report the fire. Response activation can take the form of an early warning sign like weather forecasts for heat waves, floods or drought. The Department of Provincial and Local government (DPLG, 2016) states that windy, dry and wintry weather conditions coupled with crowded shack structures are some of the early warning signs of shack fires.

In South Africa, The Department of Water Affairs and Forestry (DWAF), through the National Veld and Forest Fire Act of 1998, have developed a fire danger rating aimed at rural areas that can be applied to informal settlements. The rating systems make the public and fire protection agencies aware of the likelihood of fires in specific locations (Department Provincial and Local Government (DPLG) - South Africa, 1998). A presentation made to The City of Cape Town on challenges of shack fires, identified human negligence as the main reason for these fires (CoCT Fire Rescue, 2013). The presentation further states that approximately 99% of shack fires are started by people (City of Cape Town, 2013).

Emergency response is dependent on being activated by someone or a system. If no one calls the fire department, the department will not know about the incident. Lack of proper communication channels on whom to call when a fire breaks out can result in many casualties, especially in informal settlements. Informal settlement dwellers need to be educated on how to become active first responders to shack fires and who to contact for immediate assistance (Department Provincial and Local Government (DPLG) - South Africa, 1998).

1.4 Problem statement

Loss of livelihoods, life and large-scale injuries due to fires are mainly the result of inappropriate use or ignorance of available early warning systems (EWS) and not initiating emergency response on time. The situation is worsened because the informal structures are not compliant with legal building planning requirements.

In these informal settlements, shacks are built on top of hydrants, or too close to each other. As a result, they are difficult to access. Even when a fire breaks, households move personal items onto roads to protect them from being damaged thereby hampering access affected areas. In addition to this, numerous roads are inaccessible for large fire engines and equipment that needs to be on-site to extinguish fires (Bowers, 2014). It is against this background that the study seeks to assess the status of emergency response mechanisms to informal settlement fires in Cape Town.

1.5 Research objectives

The main objective of this study was to *assess the status emergency response mechanisms to informal settlement fires*. The sub-objectives are to:

- Analyse the management of the emergency response to the shack fires of November 29, 2015, in Masiphumelele informal settlement in Cape Town.
- Outline how to improve disaster preparedness of community members in informal settlements to respond appropriately in an emergency.
- Distil lessons, successes, and good practices to inform fire emergency services in City of Cape Town on how to empower and collaborate with vulnerable community members on how to reduce and control fire incidents in settlement areas.

1.6 Research questions

Main research question: Can emergency response mechanisms in an informal settlement reduce community vulnerability?

The main research question is qualified by four sub-research questions, which are as follows:

- What preparedness mechanisms are in place to deal with informal settlement fires in Masiphumelele?
- What is the City of Cape Town's approach to shack fire response?
- How was the emergency response to Masiphumelele's informal settlement fires initiated?
- What lesson from the case study can be adopted to improve emergency response in Cape Town?

1.7 Research design and methodology

The research methodology is the process of undertaking research, given the tremendous variance in ideals, operations, and interactions. The primary purpose of the research methodology is to describe the process and nature of research to qualify readers to conduct their own research to gain answers to specific research problems (Tichapondwa *et al.,* 2013).

This case study operated primarily within the mixed methodological framework, which combines qualitative and quantitative data collection methodologies. Thus, the research first conducted a desktop review of secondary data, reports, and policy documents. For example, legislation that was reviewed included The Fire Brigade Service Act (No 99 of 1987), SANS 10090:2003 document on community safety, the Municipal Systems Act (No 32 of 2000), Firefighting magazines, research articles, and journals.

The data collection tools were developed according to the findings from secondary data collected initially. This was meant to ensure relevance of questions that were asked. Additionally, data collection tools were pre-tested and necessary adjustments were made. This was followed by administration of key informant

interviews (KII), held with community representatives and local government authorities (firefighters, South Africa Police Services, Ambulance Services), who provided an in-depth analysis of response policy and planning related issues. The study attempted to gather data in the aftermath of an incident, and it used qualitative research techniques by including narratives of first responders and survivors to gain an accurate description of how the informal settlement fire was experienced at individual and collective levels.

1.8 Reliability and validity

Eighty respondents (58 male and 22 females) who are residents of Masiphumelele informal settlement participated in the study. Reliability was ensured by pre-testing the primary data collection tools (questionnaires, and KII guidelines). Additionally, to ensure internal reliability, findings from secondary data and reports informed the development of subsequent data collection tools.

Research validity was ensured through the participation of Masiphumelele residents including fire disaster survivors. This was followed by holding of KII with community leadership and local government authorities, to ensure research validity. Data from the research findings was triangulated to strengthen the study by combining various methods. This study employed secondary sources, questionnaires, observations, and interviews (Sandelowski, 2000) for data collection.

1.9 Limitations

The research was conducted after the incident. This was purposefully done to ensure the rehabilitation process was completed. Additionally, it also ensured that the affected community members were emotionally stable and willingly participated in this study. It was possible that the affected people were no longer residing in that area. The questionnaires were all in English. Masiphumelele is predominantly Xhosa and meaning information could have been lost or distorted in translation though a translator was engaged. This made recording data from interviews difficult. Hence, some evidence was disregarded.

1.10 Chapter outline

To address the research problem in this study, the following structure was utilised.

Chapter two is mainly a literature review of emergency management response mechanisms. The chapter reviewed existing secondary data such as academic research journals, policy papers and related textbooks.

The methodology was presented in chapter three. The findings were presented in chapter four. The main discussion and conclusions of the research were presented in chapter five (An overview of the main findings of the research and policy recommendations). This last chapter provided an overview of the main findings of the study and recommendations.

1.11 Conclusion

This research will academically help researchers to identify and understand how fire disaster emergency response mechanisms are being utilised to avoid disasters in informal settlements. The participation of fire disaster survivors in Masiphumelele provides valid information that can lead to research in other academic disciplines. It is important to note that project reliability is important for ensuring the consistency of a measure or research. That is why it is necessary to pre-test data collection tools and the use of secondary data to inform development of subsequent tools. The participation of Masiphumelele residents and key informants from community representatives and local authorities ensured that the research measured relevant fire disaster variables.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on emergency management response mechanisms. It explores the theoretical perspective of emergency management and response and identifies international and local legislative arrangements in place to support emergency management and response. The capabilities of Cape Town's Fire and Rescue Services are explored through the investigation of causes and effects of shack fires, local shack fire contingency planning, shack fire support resources, equipment and emergency management.

2.2 Conceptualisation of the study

South Africa forms part of the United Nations Human Settlement programme. According to Durand-Lasserve (2006), this programme states that limited or no access to secure human habitable structures resulted in intense overcrowding and environmental problems. Increase in urban poverty and vulnerable residency exists in the arena of rapid globalisation and structural adjustment programmes, in combination with deregulation measures, government disengagement from the housing sector and integration of formal markets through land ownership registration and land titling.

These programmes together with inefficient safety net programmes and lack of poverty alleviation policies have consequently caused a spike in inequalities of resources and wealth distribution in all sections. It is a common occurrence in developing countries that the public sector finds it difficult to provide serviced land or low-income housing (Abrahams, 2016). In addition, the private sector targets high and middle-income groups with stable employment and access to credit for land development projects. The urban poor and low to moderate-income groups are forced to settle on illegal informal settlements to access land and shelter. This has increased the occurrence of informal settlements in cities. Housing delivery and informal land systems is usually the only realistic choice for meeting low-income household needs (Durand-Lasserve, 2006).

There are several variations in the arena of informal housing delivery. Over the course of 20 years, the housing policy debates kept referring to clarity on

informality and illegality of human settlements. The definition of informality raised problems for human settlement policy makers as it was seen in a negative context in instances where economic activists used it to benefit themselves. A settlement can be defined as formal or informal depending on whether the main characteristics concerning urban planning, housing and land are the same. Illegality refers to a crime or something of a menace. However, in human settlement it refers to standards not being met, such as squatter settlements on private or public land, illegal commercial suburban land subdivisions on private or customary land, and occupation of overcrowded, dilapidated buildings in city centres or densely urbanised areas (Ong, Van Dop and Fung, 1996).

Durand-Lasserve (2006), states that according to the United Nations, habitat slums are adjacent settlements where residents are exposed to problems such as insecure inhabitant status, limited access to drinkable water, limited access to sanitation and other basic need services, mediocre quality housing material and structure and overpopulation.

Residents with insecure inhabitant status mean insecure tenure. Secure tenure is the agreement between groups or individuals for the right to occupy land or property. In South Africa, informal settlements have become a common occurrence in urban life. This is because of high rural to urban migration, as is the case in Cape Town. Formal housing is expensive, thereby pushing the poor and unemployed to settle in informal settlements. These informal settlements are overcrowded and poorly structured, as they are too close to each other, making them susceptible to man-made and natural hazards. Shack fires have caused many deaths in informal settlements across South Africa, but their impact has been severely neglected by many provinces in the country (Twigg *et al.*, 2017).

According to Birkinshaw (2008), the factors that commonly cause shack fires in South Africa are lack of secure land tenure, lack of adequate housing, illegal electrical connections, and inadequate water provision.

2.2.1 History of land tenure in South Africa

Landowners often form part of local municipalities, private companies or big corporations. The price of land is dependent on the location and size of land. If land

is expensive, then occupying that land by means of residency will be equally expensive (Birkinshaw, 2008). Modise and Mtshiselwa (2013), states that the

Native Land Act of 1913 guided landownership, renting or sharecrop of land depending on the race of an individual.

Black South Africans could not purchase or rent land outside of a designated area, which was calculated to be only 8% of land in South Africa. The percentage was increased to 13% under the Native Trust and Land Act of 1936. Under the Native Act, black South Africans were not allowed to purchase land and could only utilise communal land that was administered by tribal authorities, led by government. This created 'black spots' of settlements in white farming communities. During the 1950's – 1980's, people living in black spots were forcefully removed which resulted in all commercial farms being owned by white South Africans. The effects of this are still evident as black, coloured and indian South Africans still live in segregated townships with no secure land tenure.

Informal settlers usually occupy unused land. Cape Town has not been immune to the rise of urbanisation and migration to the city, which has led to the establishment of many informal settlements. Housing in informal settlements is unregulated by the state, planned by local communities and constructed in a haphazard fashion using cheap and recycled building materials. Due to competition for space, homes are built close together with only narrow access paths, increasing risk to fire hazards.

2.3 Causes of shack fires

2.3.1 Inadequate housing

South Africa is in the throes of an unprecedented housing crisis. It faces a growing challenge in providing all citizens with access to suitable or adequate housing. This is in spite of the constitution asserting that 'everyone has the right to have access to adequate housing' and that the 'state must take reasonable legislative and other measures, within its available resources, to uphold this right' (Musewe 2012).

Several studies related to in settlements and fires have confirmed that these densely populated areas are prone to fires. In a study assessing housing inadequacy in South Africa, Marutlulle (2021) found that protests, informal

settlements, health challenges, shack fires, flooding, violence and criminality, corruption and xenophobic attacks are the ramifications of housing inadequacy in South Africa. In an incident related to Masiphumule, fire gutted the Alexandra informal settlement and the spatial agglomeration of the squatter encampments was a cause of failure to successfully quench the fire though firefighters arrived on time (Murray, 2009). In other related studies, Kahanji et al (2019), Gibson et al (2019), and Pharoah (2012) confirm that fires arise and spread due to factors related to inadequacy housing. Elsewhere in Africa and Europe, inadequate housing has been reported as a cause of fire damages (Hohmann, 2019; Obeng-Odoom, 2011).

According to South Africa's Household Survey 2017, 12.1% (1789 million households) of South Africa's 14.75 million households lived in informal housing in 2011 with Gauteng having 20.4% households living in informal settlements, North West, 18.5% and the Western Cape, 15.1%. Limpopo has the smallest percentage with 4.5% and the Eastern Cape has 6.5% (South Africa yearbook, 2017/18).

Inadequacy of housing has become a towering problem, and town planners and policymakers are struggling to solve the challenges concerning the issue (Zanganeh, Varesi & Zangiabadi, 2013). As a result, in South Africa, almost 1.3 million households have no access to piped water and as far as sanitation is concerned 8 242 924 have flush toilets, 297 847 households use bucket toilets and 748 597 households have no toilet at all. The housing backlog is presently 2.1 million (Gerber 2018). All this helps to elucidate the magnitude of inadequate housing in South Africa. The underprivileged and marginalized cannot afford to either purchase or construct houses in designated suburbs. As a result, they settle in squatter camps/informal settlements (Matunhu, 2008), which are densely populated.

The aforementioned conditions happen despite the existence of a strong legal framework, which is backed by the constitution. Thus, the Housing Act No. 107 of 1997 provides a mechanism towards a sustainable housing development process and assigned roles responsibilities to the different spheres and departments of government.

The National Norms and Standards Act of 2007 outlines the minimum requirements for appropriate housing. Houses must have a floor area of forty square meters, a bathroom with a toilet, at least two bedrooms and a living area with a kitchen and access to electricity. Shack structures are not in accordance to the National Norms and Standards Act of 2007 and materials used to build the structures make it even more susceptible to fire and the spread thereof. In these types of structures, a fallen paraffin stove is likely to cause more damage than it would have in housing structures that are more formal. Shack materials often consist of wood, plastic, light metals as well as cardboard. Formalisation of these structures is not possible; hence, land invasion units will destroy them.

2.3.2 Illegal electrical connections

With regard to electricity, households are to have forty amperes connected within six months of construction. Inadequate access to electricity is one of the major causes of informal settlement fires, as these residents often rely on candles, paraffin stoves and open fires for heating and cooking purposes. Govender, Barnes & Pieper (2011), state that electrical connections are often illegal, and wires span dangerously from one structure to another. In the case where electricity is provided to structures, it is often shared with backyard dwellers, which in turn places an enormous strain on existing infrastructure. According to the study by Govender *et al.* (2011), it was found that backyard dwellers pay the property owners up to R 200 per month for the illegal use of electricity.

Illegal electrical connections have been attributed to fire outbreaks in many settlements (Chance, 2018; Flores Quiroz, 2021; Kahanji, 2019), in Durban (Chance, 2015; Ncube & Ndovela, 2021) and in Cape Town (Gibson et al. 2019), and (Pharoah, 2012). These illegal electrical connections to backyard shacks are made of flimsy materials posing increased fire risks (Govender, 2011). Walls et al (2019) reported that in 2015 alone, fire incidents in informal settlements in 2015 in South Africa, 862 were due to illegal electrical connections (Chance, 2018).

2.3.3 Inadequate water provision

Informal settlements are a direct result of inadequate housing. According to The University of Dublin, Trinity College (2015), informal settlements are living conditions (shacks, squatter camps, slums) which lack at least one of the basic conditions of basic housing, namely adequate sanitation, improved water supply.

According to Phillips *et al.*,(2014), the provision of water is inadequate and often communal. At that time Masiphumelele had an estimated number of 9000 people sharing 5 communal standpipes. The same number of individuals shared an ablution block with five sinks used for washing. Due to the limited supply of piped water, residents are unable to start extinguishing a fire using their own resources, such as buckets. Fire hydrants in the area are often damaged due to residents breaking them and selling the spindle head for scrap metal to get extra income. Apart from the damage caused to these hydrants, people sometimes build their shacks on top of these invaluable rescue resources. Furthermore, the water pressure needed to extinguish fires is inadequate thus making firefighting efforts difficult. The Fire Protection Association of South Africa (FPASA) released South Africa's informal settlement statistics in June 2016. According to these statistics, fire departments across South Africa responded to 5191 informal settlement fires in the year of 2014. Earlier studies concur that lack of water supply severely hampers fire extinguishing operations resulting in uncontrollable result in fires spread (Kahanji et al (2019), and Gibson et al (2019), and Pharoah (20212).

2.4 Masiphumelele vulnerability assessment

For affective emergency preparedness, response and management, to mitigate informal settlement fires, a hazard and vulnerability assessment is required to understand the impact of a disaster. This enables the fire department to assign resources accordingly. A vulnerability assessment identifies and equates variables, frequency of the event, the capacity to deal with the incident and the ability to cope after the incident (Sinha, 2006).

One of the most important objectives of assessing vulnerability is to gather data to assist decision makers in risk reduction strategies. The vulnerability assessment will determine how vulnerable the specific community is and highlight initiatives to decrease vulnerability and increase the community's capacity to deal with an emergency. This will serve as an indication for emergency management to determine who is at risk and which areas are more vulnerable.

The progression of vulnerability is relevant to this study as it indicates how informal settlement fires occur. This will enable decision makers to implement risk reduction strategies at any phase of the progression to stop a disaster from occurring. The Pressure and Release model (PAR) is one of the disaster management tools used

to explain the background or manifestations of a disaster. The model demonstrates how hazards affect vulnerable people. It demonstrates how vulnerability finds its roots in the social processes and underlying causes, which are sometimes remote from the disaster incident itself (Wisner, Blaike, Cannon & Davis, 2003).

Therefore, with informal settlement fires, social manifestation and vulnerability are important for understanding the physical impacts of the hazard. Winser *et al.* (2003), states that according to the model, disaster risk is a combination of the vulnerability and hazard. In informal settlement fires, vulnerability indicators include combustible unconventional material used for structures, overcrowding and land use.

Figure 2.1: Unconventional building materials

Maregele (2013)

Wisner *et al.* (2003), state that disasters are the interaction between vulnerability and the hazard. If there are vulnerable people but no hazard, then there is no disaster. Informal settlement fires have common hazards in all settlements, which affect vulnerable people. The relationship between the hazard and vulnerability is expressed in the following equation:

$$R = \left(\frac{H}{C_H}\right) x \left[\frac{\sum(V_{econ} V_{env} V_{Soc})}{\sum(C_{econ} C_{env} C_{soc})}\right]$$

(Twigg *et al.*, 2017)

Equation 1: the disaster risk equation

The above equation symbols are as follow:

R – Risk of the hazard

H – Probability of the hazard

CH – probable impact of hazard

Veco (economy), **Venv** (environment),

Vsoc (social) - are the vulnerability factors.

These refer to the aspects of vulnerability.

Ceco (economy),

Cenv (environment),

Csoc (social) – refers to the coping capacity of the community (Twigg *et al.*, 2017)

The PAR model (Figure 2.4) by Wisner *et al.* (2003), demonstrates that disaster risk is the crossing of two opposing forces, all the vulnerability generated processes and the event, that is, informal settlement fire.

Wisner *et al* (2003), states that the diagram depicts forces that pressure people from both sides. The pressure comes from the people's vulnerability and from the severity and potential impact of the hazard.

2.4.1 Root causes of fires in Masiphumelele

Root causes are referred to as the distant processes embedded in social, political and economic issues which influenced the culture, ideologies and social relations that affect the current situation. Apartheid is an example of a root cause in the

context of informal settlement fires. It meant the separation of people according to their race legalised by the Population Registration Act of 1950. This meant people of colour were moved to marginalised areas with unconventional shelter or housing like Masiphumelele (Abahlali, 2008).

Decades later, people still live in marginalised areas. People migrate to Cape Town in search of employment and the cheapest means of accommodation is erecting a structure in an informal settlement. Emergency management decision makers need to understand that as population numbers increase, so will the need for adequate resources assigned to the hazard. Another root cause is the lack of formal housing. Brick and mortar structures withstand fires more effectively than the unconventional structures found in Masiphumelele and other informal settlements. Furthermore, the lack of land results in structures being built too close together. Information about the materials used in the erection of these structures and the inadequate space between them, will give emergency management agency's understanding on rapid fire spread in the area.

2.4.2 Dynamic pressures

Dynamic pressures push root causes to create unsafe conditions. Examples of dynamic pressures reported by Stats SA (2017) in Masiphumelele include the lack of proper infrastructure.

Furthermore, there is also the overloading of inadequate electrical supplies, which causes 'black outs'. These black outs according to community members can take months to repair. Stats SA (2017) listed more areas where proper infrastructure is needed as these areas were reported to have insufficient toilet facilities, lack of water, inaccessible roads and overcrowding is clearly visible as structures are built too close together. Wisner *et al*. (2003), states that dynamic pressures do not necessarily cause vulnerability, but with no risk management such as contingency plans for fires and legalisation enforcement, the situation progresses to unsafe conditions.

2.4.3 Unsafe conditions

Wisner *et al.* (2003), says unsafe conditions are specific ways in which vulnerabilities are expressed in space and time relating to the hazard, both which

are relative to the conditions under which community members live in Masiphumelele.

An unsafe condition, which is the last stage of the progression towards a disaster, includes a hazardous location, high levels of unemployment, low levels of education, and lack of preparedness. All these contributed before, during and after the 2015 disaster that hit Masiphumelele. Community members were in hazardous circumstances as many affected structures were built too close together. Due to lack of disaster education, community members were not prepared to deal with such a devastating situation.

In terms of emergency response to informal settlement fires, the PAR is important for contingency planning. Response readiness must include a completed risk and vulnerability assessment before a plan can be implemented effectively. Analysis is crucial as it provides legislation to be implemented for necessary interventions, which in turn improves emergency response to informal settlements. Dynamic pressures are also important during contingency planning as governmental decision makers can implement the necessary infrastructure to intervene and stop the progression before it reaches a state of unsafe conditions and in so doing strengthen and develop coping mechanisms.

Highlighting unsafe conditions assists in illuminating the high-risk areas to allocate resources accordingly.

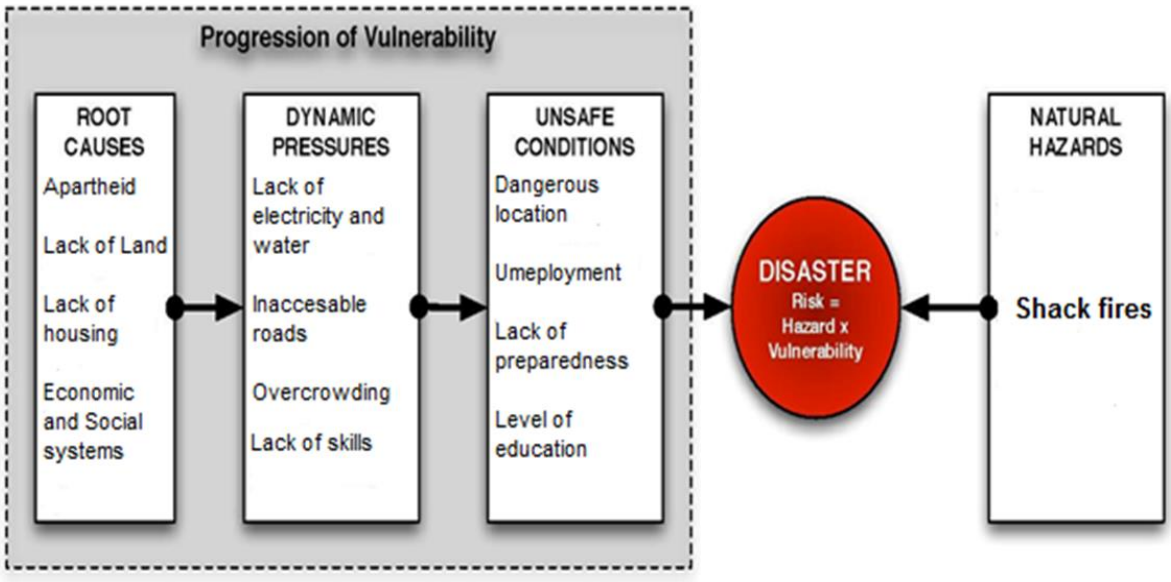

Figure 2.4 : PAR model
Wisner *et al* (2003)

2.5 Emergency management

The South African Disaster Management White Paper (1998), states that an emergency is a sudden unforeseen event that requires immediate action to minimise damaging consequences. A significant event is commonly known as an incident that requires extraordinary measures to be taken to effectively deal with the situation, however, it does not constitute a disaster. Reid (2020) defines an emergency as an unexpected event, which has a shortage of time and resources. It presents risk to life and requires immediate response, a response exceeding normal response resources or a single incident response. The terms emergency and incident (Reid, 2020) are commonly used interchangeably.

The relationship between emergency and incident is the level of response required for each. The resources needed to effectively deal with the situation can measure the magnitude of the incident. The level of response increases, as more resources are required. The main objective in emergency and disaster response is the saving of lives, property, environment and infrastructure. This can only be achieved by optimal utilisation of resources, which in turn demands coordinated actions.

2.5 1 Emergency and contingency planning

The purpose of emergency and contingency planning is to prepare a community or organisation to respond well to an incident. Effective planning leads to effective and timely emergency relief operations (IFRC, 2009).

Emergency and contingency planning can affect the efficiency of response actions. Coleman (2008) states that emergency planning is done before the incident but can be implemented during and after the incident.

Federal Emergency Management Agency (FEMA) is a well-known institution whose mission is to help people before, during and after disasters. President Jimmy Carter established FEMA in 1979 making it part of the Department of Homeland and Security. Their state and local guide for All-Hazard Emergency Operations Planning developed a national emergency management system that has a comprehensive, risk-based, and all-hazard approach (Rau, 2015).

Figure 2.5: FEMA's Six-Step planning process
Ong *et al.* (1996)

The response agencies safety complies with the health and safety act whose objectives are to save lives, to prevent further escalation of the disaster, and to protect the environment.

Coleman (2009) argues that plans should be flexible as it is not possible to document a detailed response plan for every emergency. Plans should include other necessary agencies' contact details on a database as well as available types of accommodation, resources and supplies. This will cover preliminary and longer-term arrangements.

Contingency planning for major incidents is, according to Varone (2011), the good relationship and agreed plan of action between trained personnel, medical, rescue and other services. Actions are initiated by the call to implement major incident procedures, which were agreed by all front-line emergency services. This call initiates the mobilisation of resources, specialist support and volunteer agencies. Coleman (2008) says that a contingency plan is commonly viewed as a strategic document, which includes the overarching mini plans to deal with any event, identifying role players and prescribing their roles and responsibilities during the incident.

Table 2.1 Emergency and contingency planning

Aspects	Contingency planning	Emergency planning
When	Before emergency	During emergency
Scope	Time-frame specific	More specific
Involved partners	People knowledgeable	People involvement
Focus	Projected	Actual
Planning styles	Time framed	Actual
Allocations	Quantified	Precise
Planning levels	Managerial	Field level
Time frame	Specific, uncertain, developing	Fixed
Relationships	Utilising	Developing

Chitora, (2007)

2.5.2 Emergency preparedness

Disaster preparedness occurs when the community is ready to react when a hazard occurs and are able to mitigate against the potential negative effects or impacts. Emergency planning needs training, exercising real life scenarios and the necessary resources to be effective. The plan must be a written document and the training as well as the real-life exercises should be included in the plan. When the plan is implemented, it can change according to the hazard presented and it can be adjusted to suit the systems of detection and response to the hazard. According to the mortality rates in Cape Town, it was determined that fires were the most common cause of accidental deaths after transport related accidents. An average of 300 people die due to accidental fires in the Western Cape every year (Western Cape Department of Health, 2016) In 2016, the fire mortality ASR was 5 deaths per a population of 100 000 and has remained relatively unchanged since 2010 (Figure 2.6).

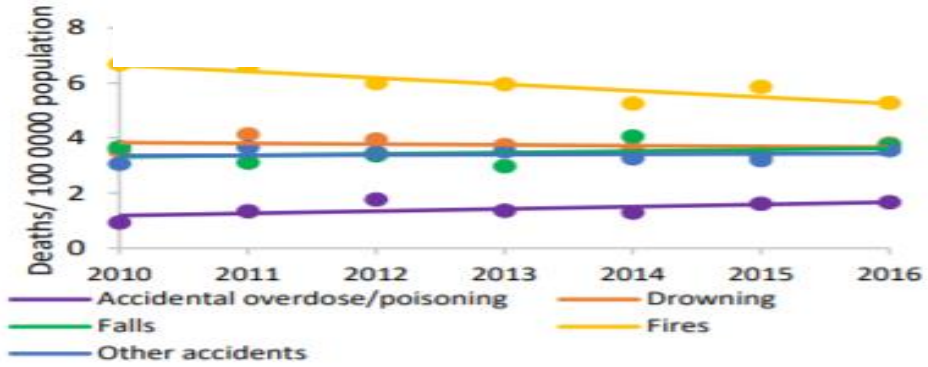

Figure 2.6: Trend in accidental deaths by major cause
Western Cape Department Health (2016)

Fire mortality ASRs were 3 times higher in males than compared to females, in addition age specific fire mortality rates were highest in males under 5 years of age and persons aged 75-79 years.

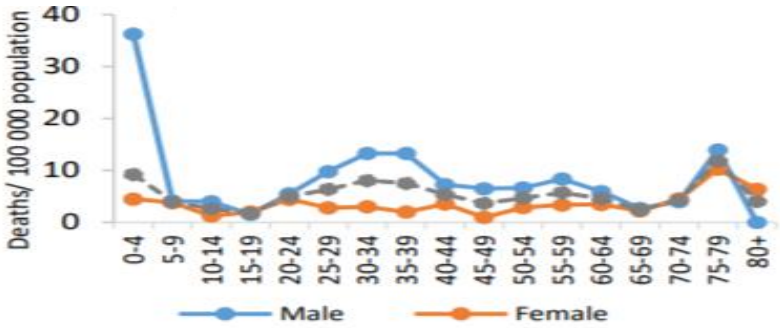

Figure 2.7: Age-specific accidental fire death rates, 2016
Western Cape Department of Health (2016)

In 2016, two thirds of all deaths due to accidental fires occurred in the Metro area (6 deaths per 100 000), Swellendam (16 deaths per 100 000), Knysna (12 deaths per 100 000) and Tygerberg (10 deaths per 100 000), sub- districts had the highest fire mortality ASRs per 100 000 population (Western Cape Department of Health, 2016). According to the figures below, deaths due to accidental fires occurred more frequently between midnight on a Saturday and 8 am on a Sunday. Alcohol was measured in 60% of the cases, of which 55% tested positive for alcohol.

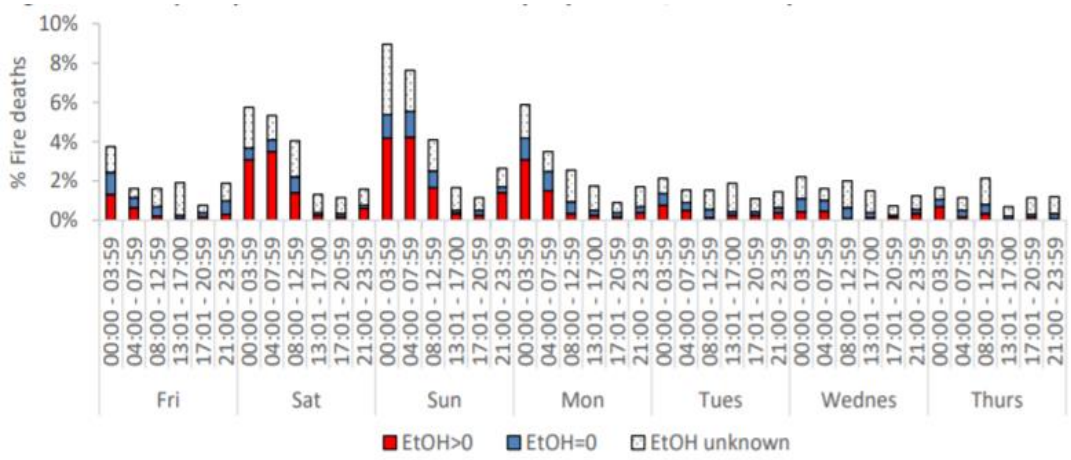

Figure 2.8: Time-specific accidental fire death rates
Western Cape Department of Health (2016)

Southern Africa, South America and regions of South Asia has had numerous shack fire deaths. Birkinshaw (2009), states there is enough land and space in the world for everyone to settle. In addition, shack fires and related deaths still affect one out of seven people in today's world. According to Birkinshaw (2009), shack fires affect 17% of the world population. Working on Fire states that the annual increase of informal settlements in South Africa has made it the main recipient of aid. Usually developing countries experience more informal settlements and shack fires, thus requiring support to save the lives of affected people (Arup Fire, 2018).

2.5.3 Incident command systems and incident levels

Incidents are categorised according to levels and with the Incident Command Systems (ICS) it is classed numerically from Type 1 incident to Type 5 incident (Incident Command Systems (ICS), 2016).

The Incident Command System (ICS) is a management system designed to enable effective and efficient domestic incident management by integrating a combination of facilities, equipment, personnel, procedures and communications operating within a common organisational structure. The ICS is structured to facilitate activities in five major functional areas, which are command, operations, planning, logistics, intelligence & investigations, finance and administration. It is a fundamental form of management, with the purpose of enabling incident managers to identify the key concerns associated with the incident often under urgent

conditions without sacrificing attention to any component of the command system (FEMA, 2018).

2.5.3.1 Type 5 incident

A type 5 incident is a minor incident, which can be dealt with by up to 6 personnel, and one or two resources. It usually does not require a broad incident command structure. Command, other sections, and general staff positions are not needed except for the incident commander.

- Formally written incident action plans are not needed.
- The incident is normally under control within the first few hours of operations.
- Some examples of level 5 incidents are a single vehicle fire, an injured person knocked by a motor vehicle (ICS, 2016).

2.5.3.2 Type 4 incident

This is an incident where a few more (than level 5) resources are required to control the incident including a strike team or task force.

- Command and other sectional staff are activated if needed.
- The incident normally takes just one operational period in the control phase.
- The on-scene agency supervisor delegate's authority, has briefings, and ensures analysis.
- A formally written Incident action plan is not needed but operational objectives should be written down and briefed with those on the scene.
- The agency supervisor is responsible for operational plans with prioritising objectives (ICS, 2016).

2.5.3.3 Type 3 incident

Type 3 incidents exceed the capability of the first responding agencies.

- Command and general staff may be activated including a division supervisor position.
- The Incident Command organisation controls the initial actions of the incident, with a substantial number of resources and an extended attack
- Time until the incident is under control or transitioned to level 4 or 5. An Incident Action Plan is required (ICS, 2016).

2.5.3.4 Type 2 incident

The incident exceeds the capabilities of the local controlling agency and multiple operational periods expected. This level incident requires outside resources to respond and can be regional or national resources responding to manage the incident.

- Most if not all command and general staff positions will be activated and filled.
- An incident action plan is required for all operational periods.
- Many if not all of the functional units are activated and staffed.
- Normally operational personnel exceed 200 for each operational period but do not exceed 500 personnel.
- The agency supervisor responsibilities include incident analysis, briefings and a written delegation of authority (ICS, 2016).

2.5.3.5 Type 1 incident

This complex incident needs national resources for effective and safe management of operations.

- All command and staff positions are activated and exceed more than 500 personnel per operation period but do not exceed 1000 personnel.
- Branches will need to be established.
- A formally written IAP is needed for every operational period.

- Resource advisors at the base of the incident are needed.
- Local authority staff is affected and requires additional office staff for support and administrative functions (ICS, 2016).

Masiphumelele falls under Type 3 incident because command and general staff may be activated. Additionally, the incident command organisation controls the initial actions of the incident. Additional resources will be required from other support mechanisms to control the situation. This will be fortified by the development of a community-oriented incident action plan.

2.5.4 Emergency response

The difference between major incidents and disasters are explained by guidelines called *Dealing with Disaster* in the United Kingdom. They describe major incidents as any emergency that needs special arrangements implemented by one or more emergency agencies like the fire service or their National Health Service. The United Kingdom's definition of a disaster is the same as prescribed in the Disaster Management Act of South Africa (UNISDR, 2017).

The designated disaster management centre at national, provincial or local level activates its disaster joint operations centre when the need arises and supports level 3, 2 and 1 incidents. The joint operations centre must be a physical building or location and be activated to support the incident during an expanding incident by taking responsibility for coordinating and securing incident resources and provide for incident direction. The centre must have the following:

- Be staffed with trained personnel and designated officials;
- Be equipped with a communication system used to communicate regarding the incident and securing and obtaining potential resources;
- Be managed with clear policies and protocols;
- Must be applicable to all spheres of government; and

- Have personnel and resources appropriate for all levels of response needed and the joint operations centre must never take over incident command (ICS, 2016).

Response is a key element that forms part of the emergency and disaster management continuum. The National Emergency Management Agency of Nigeria (NEMA) describes response activities as activities that address the immediate needs of the disaster or emergency (NEMA, 2017). The NEMA defines response as activities that address the immediate effects of an emergency or disaster. The NEMA further states that response includes actions to save lives, property and meet human needs (NEMA, 2017).

The United Nations International Strategy for Disaster Reduction (UNISDR) incorporates both the nature of actions and time into their definition of response including terms like immediate, short term or protracted duration. Response encompasses operational actions whether immediate, short term or protracted, time deals with the consequences of the event with the intention of saving lives, limit property, environment and infrastructure damage and provide humanitarian needs.

2.5.4.1 Response agencies

The word agency, according to the Oxford dictionary is defined as a business or organisation providing a service on behalf of another business, person or group. It is also described as a department or body providing a specific service for a government or other organisation (Lexico Dictionaries English, 2020).

Minnaar (2004) states that emergency response requires the collaboration of a variety of agencies that include fire and rescue, South Africa Police Service (SAPS) and Ambulance services, among others. Minnaar (2004) also identifies additional support or utilities agencies such as the electrical and sewerage departments, corporate sector, NGOs and religious groups. This approach will help to ensure a holistic approach in dealing with the needs of disaster survivors.

The regulatory and statutory arrangements, which govern key response agencies, which have a duty to respond to emergencies, are listed below:

- Road Traffic Services

- South African Police Service (SAPS)
- Fire & Rescue Services
- Ambulance Service
- Disaster management
- Defence force

2.5.4.1.1 Road traffic services

The Road Traffic Act 21 of 1999 details the powers and duties of traffic officers. Their powers relate to controlling of traffic and they have the right to close public roads if requested to do so. Road closures because of fires are normally requested especially if smoke blows across roads and hampers visibility for road users, which necessitates route detours for the safety of the public.

2.5.4.1.2 South African Police Service

The South African Police Service Act 83 of 1995 mandates police services with the broad responsibilities of securing safety and security of all people within the republic, ensuring the safety of property and the protection of human rights.

No legislation gives specific functions or authority for road traffic or police services within the incident command setup even though they play crucial roles. The police are often used to obtain or sustain law and order during fires and other incidents. The police service does not have specific authority in a multi-agency response. Stephens (2011) states that police officers are given training to manage incidents where the primary duty is a policing responsibility. If the primary action is not policing related, then they are available as a support service.

2.5.4.1.3 The Fire Department

The Fire Brigade Service Act 99 of 1987 provides for the employment, establishment, maintenance, standardisation and coordination of the fire department and functions linked to them. Apart from extinguishing fires, saving lives and property the fire department provides emergency medical care and

rescue services. There is no stipulation in The Fire Act that gives the Chief Fire officer representative authority over other services in a multi-agency incident. The Fire Department uses the incident command system during large incidents where other services are involved. When the incident is escalated or protracted due to a fire then it is logical for the fire department to lead and when involved in non-fire related incidents they will act in a supporting role during rescue and medical care.

2.5.4.1.4 Ambulance services

The National Health Act 61 of 2003 rests the responsibility of coordinating health and medical activities on the Department of Health during a National Disaster. The Health Act gives the Provincial Health Department medical and health care responsibilities during a disaster of provincial nature. The Health Act does not make provision for coordination between the Health Department and support agencies nor for its function in an incident command set-up. The Board for Emergency Medical Care provides strict protocols that govern operational emergency care personnel. The protocol does not give guidelines regarding responsibilities during a multiple agency response or actions in incident command. However, it gives authority to the highest medically qualified person when dealing with other emergency care personnel. Agencies adopt and implement their own standard operating procedures when working with other agencies (Reid, 2020).

2.5.4.2 Command, Control, Coordination and Direction

The terms command, control and coordination are important to understand in relation to emergency response and are commonly used together in emergency management operations. Ryan (2017) defines command as the exercise of extreme authority and defines control as the overall direction of response activities, which operates horizontally across agencies. Coordination is the bringing together of different resources and agencies to ensure effective response and onsite emergency management. Control is responsible for activities relating to emergency response; command and coordination provides the support to the controlling authority.

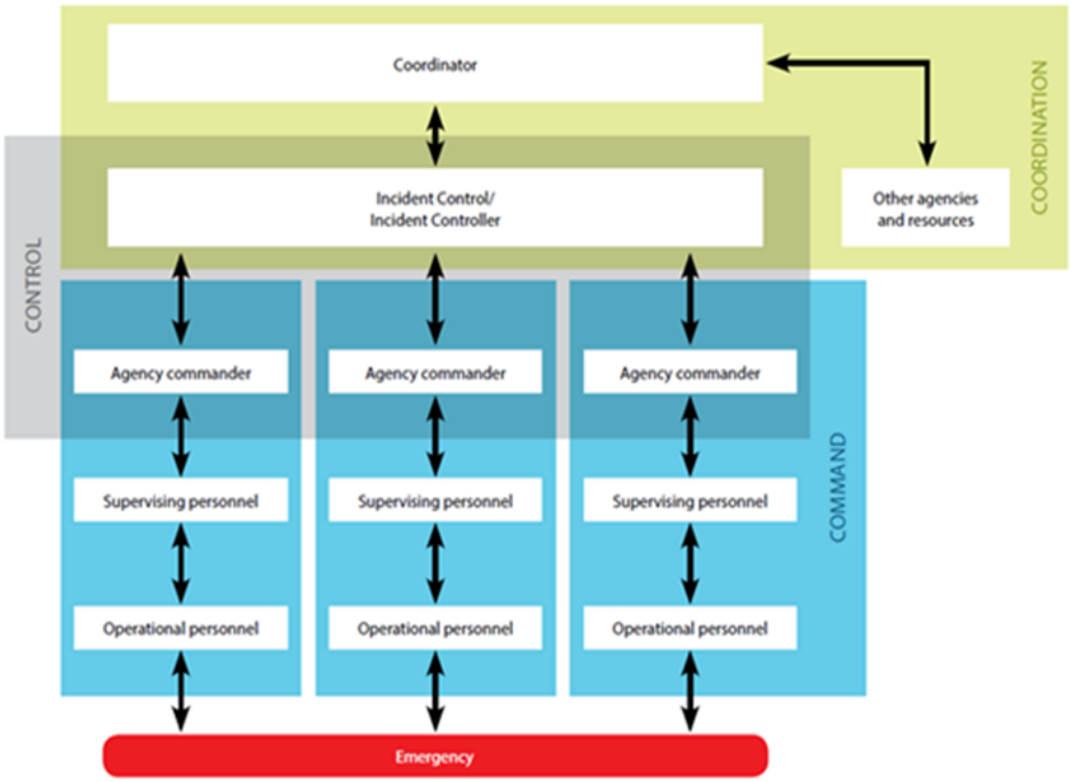

Figure 2.9: Emergency management
Ryan (2017)

Command in the UK is understood as the authority for a specific agency which directs all the actions of the resources, both human and equipment, it forms part of the agency's day-to-day functions within their operational response activities.

Command implies to have the legal authority to order personnel and resources within a designated organisation and make decisions regarding operational activities. Command is the direction that vertically takes place and is confined to a specific organisation. It necessitates an agreement to work with another specified organisation in the emergency response arena.

Milenković and Kekic (2016), states that command-and-control models have taken the concepts from the military and that command-and-control authorities are top-down structures. However, during emergency or disaster management, a single authority is not possible especially where multiple agencies are involved, and the magnitude of the event is severe. Drabek and Haas (1991), acknowledges that an authority is needed at these multi-agency events, but further states that it should not be a centralised external authority. Furthermore, it is argued that the authority that already exists or has local jurisdiction within the

functional responsibilities should escalate according to the needs of the emergency and coordinate arriving resources.

The ICS (2016) argues that a command system must be established and set up from the start of an incident. The agency that has primary jurisdictional authority over the designated area appoints an official responsible for establishing incident command. Command can be transferred as more agencies arrive on the scene. When this is done, the process includes a briefing where all valuable information is communicated to ensure continuation of effective and safe operations.

The International Federation of the Red Cross and Red Crescent Societies (IFRC) (2009), states that coordination is adjusting movements or making harmonious combinations. Coordinating emergency response is challenging yet crucial, an emergency requires quick decision making in the face of limited information and constrained resources. Coordination affects short- and long-term results with the help of pre-incident preparedness however; this can lead to response inflexibility when unexpected events occur. Uncertainties in emergency response are usually about the hazard, information, environment, task flow and organisational structure. These can be minimised by prioritisation, improvisation and sourcing of capacities from agencies and other communities. Emergency or disaster responders must make rapid coordination decisions, which affect their capability to correctly identify and resolve coordination challenges (IFRC, 2009).

Direction is difficult to control as it is activated when a major incident occurs, and a higher level of authority is requested, where control is applied to guide operations and coordinate resources for optimal use. The need for senior managers to respond to an emergency or disaster indicates that the event must have escalated beyond lower managers' competencies or authority. Senior management has the authority to make executive decisions and release resources. Executive policy decisions are made at higher levels of emergency management. This is the highest level of response.

2.5.4.3 Chain of command and unity of command

The chain of command is an orderly and specific line of authority organised within the ranks of the organisation. Individuals within the organisation have a designated supervisor to whom they report. That supervisor also has a superior to whom they report. It continues until the most senior person is called upon.

During an incident, this reporting structure eliminates confusion caused by too many supervising directives. Incident supervisors at all levels should be informed of control actions of staff reporting to them.

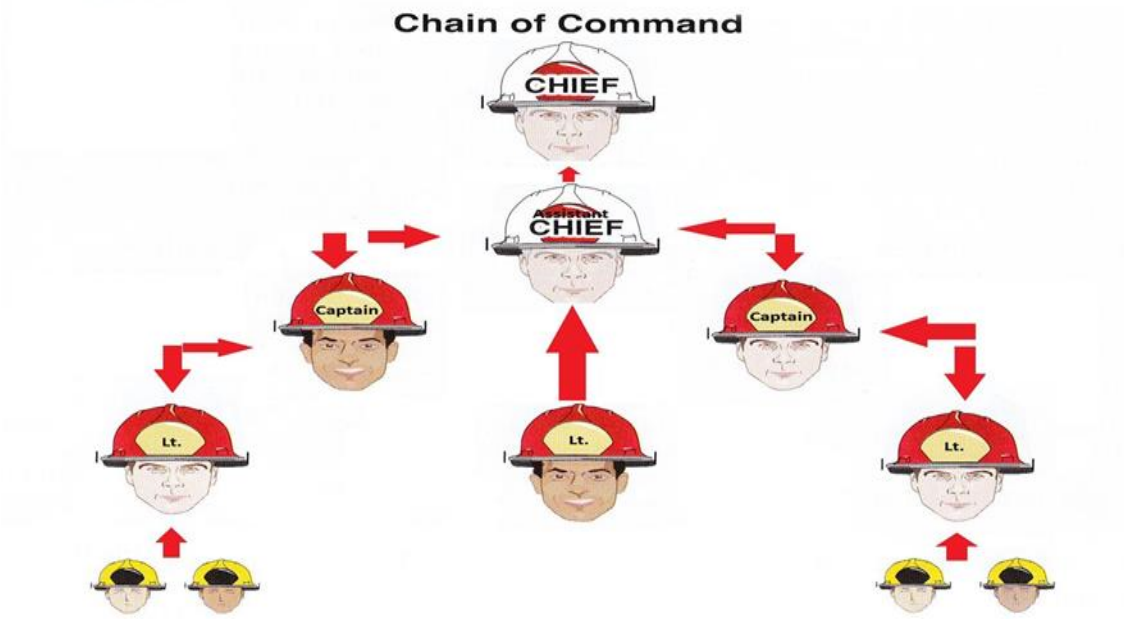

Figure 2.10: Chain of command
Source: ICS (2016)

2.5.4.4 Unified command

Incidents with multi jurisdiction or a single jurisdiction with the involvement of various agencies or multiple jurisdictions with various agencies need to establish and implement a unified command system. A unified command system allows different agencies to work together effectively without interrupting a single agency's responsibility or accountability.

Figure 2.11: Unified command
Source: ICS (2016)

2.5.4.5 Span of control

The concept span of control refers to the notion that an individual manager cannot effectively manage a large subordinate group. To date, no specific studies have established the optimal span of control for public health. Studies done by the United States military suggest span of control in the range of 3 - 7 persons supervised per manager. Therefore, it is essential that the agency, incident commander and section chiefs consider the span of control whilst establishing assignments for managers. Factors to consider include the nature of the incident, tasks to be performed, existing or potential hazards, safety factors, and distances between personnel and resources (McKing, 2008).

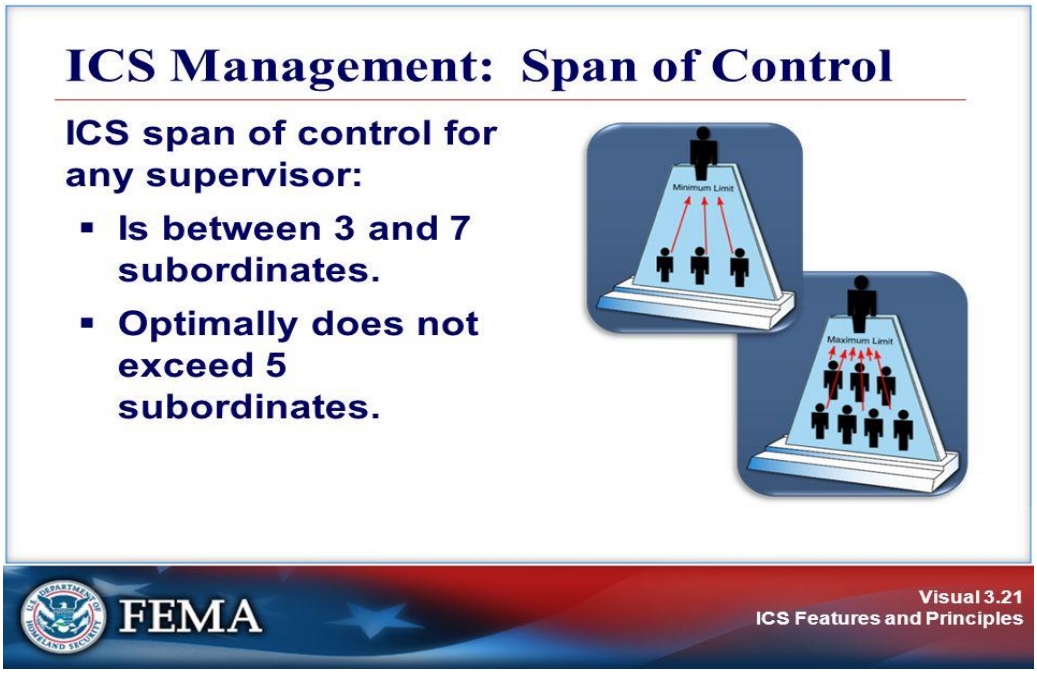

Figure 2.12: National incident management system
Radvanovsky and McDougall (2009)

2.5.5 Emergency management: Common responsibilities of responding agencies

The following responsibilities are applicable to all agencies arriving at the incident or within the Incident Command System (ICS, 2016).

2.5.5.1 Primary responsibilities of all agencies

- To receive their assignment, necessary travel instructions, reporting location and responding time.
- Get agency specific communication instructions for example, which radio frequency to use.
- Get a description of the incident.
- Get equipment such as important personal protective equipment.

2.5.5.2 Secondary responsibilities

- Upon arrival at a scene, check-in at the incident command post.
- Report to the section supervisor and receive briefing from him or her.

- Send a representative to the incident meetings and briefings as needed.
- Maintain responsibility and accountability for all personnel and resources assigned.
- Comply with all safety procedures and practices.
- Supervisors should organise, brief and assign their assistants.

2.5.5.3 Tertiary responsibilities

- To use clear and common terminology and text.
- Complete required logs and other necessary documentation and incident forms.
- Ensure that all equipment is in operational condition ready for each working day.
- Respond to demobilisation instructions and briefing of subordinates on demobilisation.

2.5.6 Emergency management: City of Cape Town's response to shack fires

The South African National Standard community protection against fire (SANS, 2003) states that the functions of the fire service include the protection of life and property in the event of a fire. To accomplish these functions, the service needs to be well organised. This document describes municipalities according to the risk factors involved and their capacity to attend to these risks with a level 1 category brigade to meet the highest performance criteria.

2.5.6.1 Fire risk categories

The fire risk is categorised to serve as a guideline for municipalities for resource allocation:

A **category A** municipality has a central business district. It has an extensive industrial and commercial area, and this is found in large towns and cities like Cape Town. Humans and property are at high risk should a fire incident occur, the fire spread is likely to be high.

A **category B** municipality has limited central business districts, which have smaller commercial and industrial areas that are commonly associated with small towns. In the event of a fire, the damage is likely to be moderate.

A **category C** municipality is a residential area with typical constructions.

Category D municipalities are rural in nature with limited buildings and are isolated or located further away from urban areas.

Category E municipalities are areas with special risks; these areas need a pre-calculated response and attendance. These include harbours, hospitals, airports, informal settlements, petrochemical plants, large shopping malls and prisons.

The City of Cape Town has a large population density and large residential areas and comprehensive industrial and business districts. Consequently, the City of Cape Town municipality is within the highest fire risk category, which is Category A. An example is the Masiphumelele fire, which caused the displacement of many people. Risk profiling and categorising of a designated area directs resource allocation to the right area and directs the speed in response and expected attendance times for fires in all the risk categories.

According to the SANS (2003) all municipalities' fire departments are categorised according to the type and quantity of resources and equipment available.

Category 5 a): this is a fire brigade with the correct provisions and arrangements in place, in relation to the risk as per the municipality's category:

- Risk profiling of the specific area
- Speed and weight of response
- Emergency call receipt and procedures in place for processing requirements
- Equipment and vehicle maintenance, and availability
- Incident command and management procedures
- Risk visits and pre-planning
- Training capabilities and personnel availability

- Water capacity
- Fire safety capabilities

Category 5 b): a fire brigade that fits the performance criteria for staff per appliance availability and predetermined attendance. Attendance times and the required manning levels at 35% - 45% of the time, which is measured once a year.

Cape Town's fire department is classified as one of the highest categories, which is category 1, this falls under category 5 a. Performance indicators are used to monitor the fire department and can meet the performance criteria of category 5 b more than 75% of the time as measured annually.

2.5.6.2 Weight of response

The SANS (10090:2003) document on community safety prescribes that all fire appliances in the city's fire department should be in a state of readiness and provide adequate fire protection for their demarcated areas. Vehicles and appliances should all be compliant with NFPA 1901 (National Fire Protection Association: Standard for Automotive Fire Apparatus) which is an international standard applied to all fire appliances. Smaller districts fire departments with one fire station should be adequately equipped to meet all the demands of the first incident where a vehicle is required. The City of Cape Town's Fire and Rescue services has 29 fire stations across the city. Therefore, according to SANS, all response vehicles should fit the risks categories in their assigned areas.

The following are response times and turn out times for the different risk categories prescribed by the SANS.

Table 2.2: Weight and response to fires

1	2	3	4
Risk category	**Minimum number of pumping units**	**Minimum manning level per appliance**	**Minimum pumping capacity of each unit (L/min)**
A	2	5	3 850
B	2	4	3 850
C	1	4	2 250
D	1	4	2 250
E	As determined by individual risk assessment		
NOTE Arrangements for vehicle fires, grass/bush fires and special services and the need for specialist vehicles such as aerial appliances and water carriers will be determined by local conditions			

Source: SANS 10090 (2003)

Table 2.3: Attendance times during fires

1	2	3	4
Risk category	**Maximum call receipt and turn-out time** H	**Maximum appliance travel time** h	**Maximum attendance time** h
A	3	5	8
B	3	7	10
C	3	10	13
D	3	20	23
E	Within requirement of appropriate risk category		

Source: SANS 10090 (2003)

As indicated by the above tables, fire appliances should not take more than 3 minutes to respond to shack fires, and a minimum of two appliances should be actuated to respond with water pumping capacities of 3850 litres per minute at 7-bar pressure.

The city's fire and rescue service have various emergency appliances. The two appliances used most often during emergencies include the fire truck as seen below and the water tender. One type of fire truck is the Mercedes Destroyer. The call sign is unique to every fire apparatus and this destroyer's call sign is E11

(Echo 11). Echo vehicles are the primary vehicles at any emergency. Five staff members including one driver-pump operator, one officer and three fire fighters man this vehicle.

Figure 2.13: Fire truck
Source: Everts (2014)

The Destroyer has a Godiva World Series 4010 multi pressure. It has one normal pressure impeller (centrifugal) and one high-pressure impeller (peripheral). The Destroyer holds 3000 litres of water and has a double piston primer with a priming speed of 1000 rpm. It also holds 200 litres of foam and at 10-bar pressure; it can deliver 4000 litres of water per minute.

Another common type of vehicle is the Man Water Tender 4 x 4 that is used as a water carrier in places where there are no hydrants or water. This vehicle is used as a support vehicle and manned by fire fighters, a driver and support staff. These water tenders call sign starts with a 'W' for example, W 10 (whiskey ten). Every fire station is equipped with an echo and whisky vehicle and depending on the area of designation; the station can be equipped with two of each.

2.5.6.3 Setting up of fire stations and determination of station areas

Fire stations are strategically placed in risk areas and according to their predetermined attendance times. The distances and area to cover while travelling are all considered.

Indicated in the table below are the station response areas under different conditions and with the application of the average speed of fire appliances. Once all the variables that hinder response are determined, trial runs, or live practises should take place with the vehicles likely to respond to these areas and trail runs should be verified and documented.

Table 2.4: Setting up of fire stations

Table: station areas: 1	2	3	4	5
Estimated speed of vehicles km/h	**Possible response area for various risk categories** km2			
	A	B	C	D
25	8	15	30	120
30	10	20	40	180
35	15	30	60	240
40	20	40	80	320
45	25	50	100	400
50	30	60	120	480

Please note:

- The estimated speed of vehicles is the average speed between two points in the identified risk area, which include stops, possible traffic and considering the terrain as well.
- Fire Station Response area is that area that the vehicles can effectively respond to, taking speed and weight of response into consideration.
- Straight-line distances are used in the above response areas. The distance that can be reached with the predetermined vehicle travel time minus 25% to take street grid networks into consideration.

Source: SANS 10090 (2003)

The City of Cape Town's fire brigade is a professional Fire and Rescue service with history dating back to 1845. The city's fire brigade aims to provide a cost effective, unprejudiced and equitable fire and rescue service to all visitors and residents in Cape Town. The city has 30 fire stations, serving a population of 3.5 million people in an area of 2600 km ^{2}. The fire service is divided into three

geographical divisions with more than 1500 staff members, which includes fire and life safety staff, fire fighters, fire trainers, and support staff, as well as command and control staff.

The fire service deals with various incidents, including structural fires, mountain fires, veld fires, informal settlement fires, motor, and transport vessel fires. Furthermore, they also respond to medical emergencies, urban search, and rescue, diving for water and sea rescue, extraction of trapped victims in vehicles and other entrapment situations, hazardous material emergencies, as well as high angle emergencies.

The command-and-control centre in Goodwood is a dedicated call centre for emergency calls, and from there resources are mobilised. The emergency call centre is equipped with communication hardware to maintain communication links with on scene crews and emergency vehicles providing support in concluding the emergency incident.

To prevent loss of life, destruction of property, and to protect the environment from the damaging effects of fire and other hazards, the city's fire service aims to sustain a safe environment for residents and visitors to the city by:

- Creating awareness of dangers that accompany fires in the communities.
- Educating Cape Town's visitors, residents, and the city's staff on how to decrease fire dangers.
- Developing and training staff and residents in the city to increase their skills and knowledge on fighting and preventing fires.
- Procuring resources for all departments within the fire service to carry out their functions.
- Ensuring that resources and assets are maintained and kept in a state of readiness.
- Responding to emergencies within the city's boundaries, in the shortest possible amount of time.
- Record keeping and researching.

- All incidences and emergencies attended.

2.5.6.4 Telephone lines

Telephone lines for emergencies are needed to initiate response to incidents. Therefore, an adequate number of dedicated emergency lines are needed to cover all the calls from a designated population. The table below prescribes the number of emergency lines required to respond effectively to the needs of the population (SANS, 2003).

Table 2.5: Emergency telephone lines

Population Total	Number of emergency lines required
Up to 40 000	1
40 001 – 125 000	2
125 001 – 300 000	3
Over 300 000	4

Source: SANS 10090 (2003)

The city's command and control centre are in the Fire and Rescue headquarters in Goodwood. The city's entire Fire and Rescue's vehicle despatching and call receiving station is operated from this centre. Each fire station in the city has a watch room, which is manned by a control room operator 24/7, which forms a decentralised support or back up for the centralised control centre.

Prior to 2003, the City had six separate fire control centres each providing a communication centre to a dedicated number of fire stations in the designated local authority. In 2003, the six separate local authority control centres were amalgamated into one main control centre. A dedicated communication network namely, Emergency Service System (ESS) dispatching system was implemented at each of the 30 citywide fire stations.

The Command-and-Control Centre's purpose is built on three basic principles, which are command and control, centralised dispatch and call taking, nearest station dispatch. All emergency calls for the city goes via the command-and-control centre. There are three ways to report an emergency to the centre; it can be done by direct alarm, via radio and or by telephone.

Dispatch and call taking, takes place at different consoles within the command-and-control centre. The centre has twelve dedicated operator consoles which is staffed 24/7 with one supervisor console, three radio consoles with a radio dispatcher, six call-taking consoles, one alarm console for direct alarms and one console for camera monitoring.

Figure 2.14: Command and control centre
Source: Everts (2014)

The City utilises ESS, which is a CAD program under licence from a private company, Sysman. The network is linked to all 30 fire stations. When the incident is concluded, the officer completes a fire report of the incident then submits it for further processing.

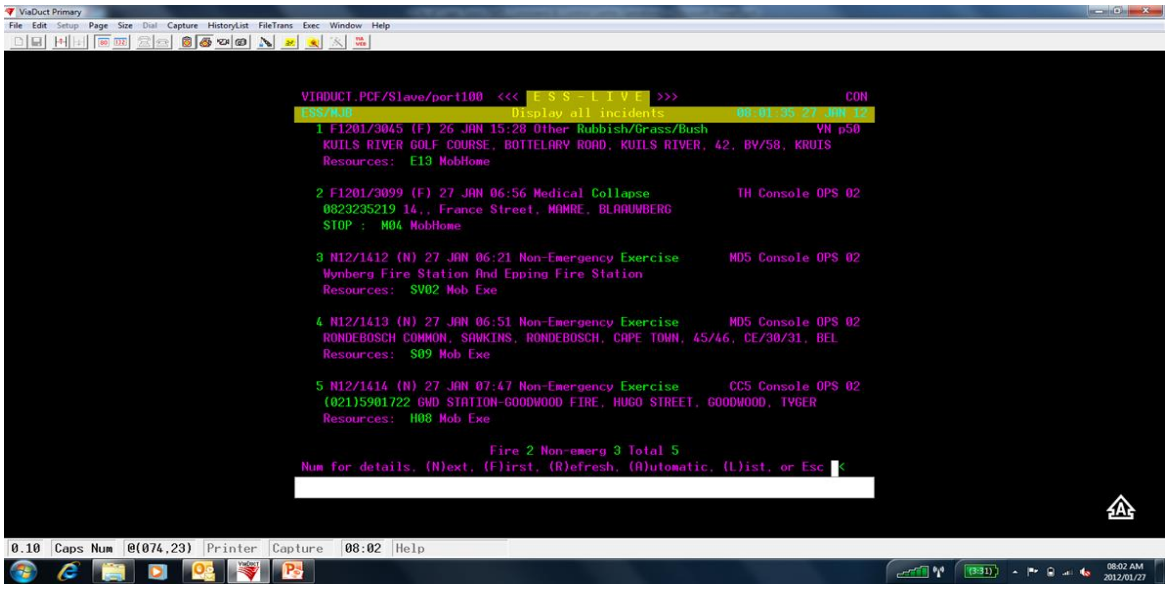

Figure 2.15: Emergency service system
Source: Everts (2014)

Due to the frequency of informal settlement fires, a programme was implemented where fire-monitoring cameras were strategically placed in the city. A command-and-control centre monitors the cameras. These cameras are placed near large informal settlements to assist in early first response activation.

2.5.7 Incident command

2.5.7.1 Incident Management System

Incident Management System (IMS) provides a systematic framework for agencies responding to an emergency or disaster. It promotes efficient and effective management of an emergency regardless of its magnitude. Its main objective is to ensure cooperative, joint operations between multiple agencies whilst not interfering with the command system or authority of the independent response agencies. An IMS is not meant for onsite operational area or levels but for strategic and tactical levels that occur away from the incident. The design of the system makes provision for it to progress from a single agency event, with a routine command structure, expanding as the demand for additional resources increase and higher levels of authority are activated.

Technically, incident management as opposed to incident command does not confine itself to the operational level of on-site management but provides a framework that allows response management to expand naturally, as the situation escalates in magnitude and complexity. This takes the management of the response from the incident site, into the boardroom and even beyond state and national spheres as the demand dictates. The Incident Command System (ICS) is a standardised-on scene emergency management model designed to assist users to implement and integrate organisational structures, which match the demands and complexity of the event without interfering with the jurisdictional boundaries.

According to the Federal management and publication (1999), the ICS is a model for command, control and coordination of emergency response and provides a platform for agencies to work together to achieve the common goal of saving lives, property, the environment, and stabilisation of the incident. According to Plan (2014), incident management denotes a holistic system that embraces the concepts of co-ordination, command and control of response to any occurrence regardless of the magnitude. Its purpose is to ensure effective joint operations

across disciplines and sectors at all levels, whilst not impinging on the authority or command systems within the individual response agencies (Plan, 2014).

More importantly, ICS is a general vertical command system, which is applied to the operational activities of a responding agency. One of its major advantages is that it creates a standard in situations where multiple agencies from the same discipline, but from different jurisdictions are involved and need to work together to reach the same objective. The same will apply for multiple agencies from different disciplines, like in the case of search and rescue where ambulance service, fire fighters and police commonly work together.

An inter-agency IMS is described as a protocol for managing people and equipment during a crisis. The success of dealing with an incident, depends on the way in which they assess the incident and apply strategies, resources, and coordinates actions to normalise the event (Federal, Management and Publication, 1999). The process of decision-making is referred to as incident management and is documented into an incident management system. Every fire department should develop policies and procedures concerning IMS, and it should be documented and assessable to all employees. An IMS should have clear objectives and include the rescue of people and property, medical treatment available for the injured, provision of safety and stabilisation of the incident as soon as possible, property and environmental protection, and the provision of safety for all personnel at the scene.

The success of the system depends on each participant using standard operating procedures; uniform terminology and common radio frequencies, even though response may involve many agencies.

Therefore, the ICS can be applied to any event, and is based on the following characteristics:

- Unity of command
- Integrated communication system
- Span of control
- Common terminology

- Consolidated incident action plans
- Designated incident facilities
- Comprehensive resource management
- A modular organisation (Federal, Management and Publication, 1999)

The key characteristic of the ICS is that it is designed to coordinate the actions of multiple agencies under a unified command. It establishes the foundations of management mechanisms for first and second level of response. Furthermore, it makes provision for the movement to higher levels of response.

As such, it is used for controlling, commanding and coordinating the endeavours of single or multiple agencies as they work to achieve a common objective. With this system, agencies working together use non-agency standard terminology. This system provides for the capability to expand or contract as necessary according to the situation, as well as facilitate non-standard, non-integrated communications. It further provides for effective consolidated action plans and designated facilities.

The main advantages of an incident command system are that it prevents chaos as well as individualism. It prevents further damage, injury, and the prolongation of the incident. This system can be implemented for hazardous material incidents, planned events, responding to natural hazards, fires, mass casualty, transport related accidents, pest eradication programmes and any other incident or event needing collaboration between agencies (Western Cape, 2015).

Numerous studies highlight inadequate communication between management, lack of resources or ineffective tactics as the root causes of response problems (Chief Director of Disaster Management for Fire & Rescue Services, Western Cape). These problems are commonly by-products of poor planning, lack of accountability and lack of knowledge of common terminology during incidents. It is critical to note that the ICS was developed after the terrorist attack on the world trade centre, which is commonly known today as 9/11. The Department of Homeland Security in the United States sanctioned emergency services or respond agencies of every department to use ICS when responding to and managing emergencies (Western Cape, 2015).

The ICS is used during thousands of incidents across the world and its application can be used for single victim incidents to multiple or large-scale incidents. In view of the foregoing, the Western Province in South Africa adopted the ICS with input from various local response specialists. The Western Cape fire and rescue services and disaster management team cooperated with several agencies including experienced ICS specialists from the United States of America. The ICS was later contextualised to suit local needs (Western Cape, 2015).

The Western Cape's Provincial Disaster Management and other stakeholders piloted the ICS during the veld and mountain fires breakout that took place between February and March 2015. It was proven that ICS was effective at coordinating and guiding various emergency response stakeholders. As a result, there was a great need to educate and lobby all disaster response stakeholders to adopt and continuously update it (Western Cape, 2015).

The ICS has the following basic functionalities, structured in the diagram below:

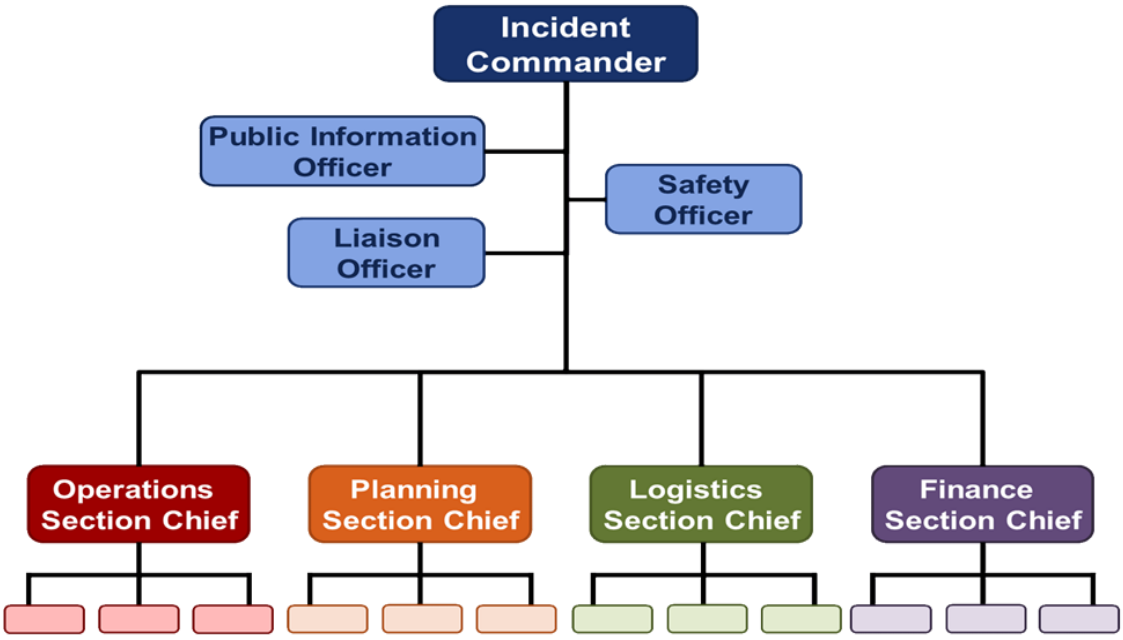

Figure 2.16: ICS functions
Source: Castro (2013)

2.5.7.2 Incident commander

The Incident commander takes charge and is responsible for all facets of the emergency response. The commander's responsibilities include performing

command activities, protection of life and property, controlling of personnel and resources, maintaining the responder's safety, public safety, task accomplishment and establishing cooperation with other agencies at the same incident.

2.5.7.3 ICS Toolkit in Western Province

The incident command toolkit's purpose is to assist those agencies at local level responding to the incident to implement the Incident Command System. It describes the structure of the incident command system and how incident objectives can be achieved. The ICS toolkit is aimed at:

- Managers and organisations responsible for emergency response and planning namely fire and rescue services, disaster management officials, hazmat response teams, medical teams and more.
- International and national officials responsible for emergency management. Emergency management organisations, public health authorities, national disaster management representatives and sectoral departments that are responsible for its citizens' safety and security as well as the country's environment and resources that are vulnerable to hazards.
- The effect of the emergency is felt at the community level; hence, the need to develop community emergency preparedness plans.
- For disaster preparedness to succeed, the participation of the community is crucial and also commitment from the local, provincial, and national government. Using a multi–sectoral approach means multiple organisations have clear and concise responsibilities and need to coordinate their assigned efforts. Without a multi-sectoral approach disaster preparedness becomes poorly coordinated, fragmented and poorly conducted.

2.5.7.4 Site 5, Masipumelele incident, 29 November 2015

According to the incident report (Appendix 4) of the City of Cape Town fire and rescue service, report number F1511/3854, Command and control received an emergency call from a cell phone stating informal structures alight at 00:21 am on the morning of 29 November 2015.

Upon receiving the call, the dispatcher dispatched an Echo (E49) vehicle from Fishoek fire station, which is 4.8 km away from the incident and another Echo (E35) vehicle from the next closest station, which is Simons Town, 18 km away (Fishoek, 2016).

E49 left to attend to the incident at 00:28 am and arrived at the incident at 00:34 am. On arrival, the crew started to fight the fire with hand lines using 1000000 litres of water over several hours (Fishoek, 2016).

The first support vehicle, E35 arrived at the fire scene at 00:39 am. Another seven echo vehicles were requested. The furthest Echo vehicle travelled 105 km to the incident. Due to the water quantity needed, five whiskey vehicles were requested from across the city's fire stations (Fishoek, 2016).

Other services also responded, which included the Metro Ambulance Services, South African Police Services, Disaster management, Electrical Department, Animal welfare services, Metro police and the Department of water works (Fishoek, 2016).

Incident command was established, and different sections were established to control the scene. Section A used hand lines and used 1000000 litres of water. Section B used hand lines and 964860 litres of water. Section C used 2 hand lines and 54300 litres of water. Section D had 3 hand lines in use with 21600 litres of water (Fishoek, 2016).

According to the incident report (Appendix 4) one helicopter was also used to assist in water bombing. It was suspected that the cause of the fire was drunk residents who left a cooking fire unattended (Fishoek, 2016).

2.6 Conclusion

One of Cape Town's worst informal settlement fires occurred on November 29, 2015. This chapter investigated emergency management response mechanisms as well as incident command system through studying and reviewing relevant literature. The main reason for these informal settlement fires occurring is the lack of education regarding fire safety in informal communities, over population and crowding of small urban areas. Informal settlers usually occupy unused land, and

their structures are often built with combustible material such as wood, cardboard, and light metals. Due to limited space, these combustible structures are built near each other which aids the intensity with which these fires burn and make rapid fire spread through conduction a continuous threat. Effective emergency preparedness as well as response management depends on a hazard or vulnerability assessment to understand the impact of the disaster as discussed using the PAR model. For these assessments to be carried out accurately, the incident command system as well as various contributing factors needs to be understood. Several areas of communication and planning concerning informal settlement fires can be improved upon, thus further research must be conducted.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter focuses on the methods followed to gather data for this research. The methods utilised were appropriate for the study area and the circumstances surrounding the disaster.

3.2 A review of the research design and methodology

3.2.1 Research design

A research design is defined as a plan, strategy, and structure of investigation to formulate answers to the research questions and control variances (Penuel, Gallagher and Moorthy, 2011). Research designs have many forms like case studies, surveys, historical data analysis and participatory research methodology (Ifunanya, 2010). The primary purpose of a research design is to make sure that the evidence gathered enables the researcher to answer the initial question as explicitly as possible.

For the purpose of this research, a case study research design was followed. Yin (2011), states that case study research continues to be an essential form of social science inquiry. Flyvbjerg (2006) defines a case study as the detailed examination of a single example of a class of phenomena. A case study cannot provide reliable information about the broader class, but it may be useful in the preliminary stages of an investigation since it provides hypotheses, which may be tested systematically with a large number of cases (Flyvbjerg, 2006).

The Masiphumelele fire is one such case study that the research is based on and as stated by Flyvberg (2006), it will be tested against case studies identified as secondary data in the form of fire incident and emergency response reports housed by the City of Cape Town Fire and Rescue Services.

3.2.2 Data collection and research methods

The type of data that was required to gain a more in depth understanding of emergency response to informal settlement fires required a mixed method approach of data collection. Quantitative secondary data was used to view the number of fires that took place in the designated area over a period, and the number of people who responded. Qualitative data (from closed and open-ended

questionnaires) was used to gain a deeper understanding of the experiences of community members. According to Trochim (2007), quantitative and qualitative data is inseparable and does not exist in a vacuum. To carry out good research, Trochim (2007) believes that researchers need to make use of both qualitative and quantitative methods (Soiferman, 2010). Mors (2009) found that mixed method research often involves the use of both qualitative and quantitative methods.

3.2.2.1 Surveys

This study used the survey method to gather primary data. Navarro-Rivera and Kosmin (2013) argue that surveys are a traditional way of conducting research. They are useful for non-experimental descriptive designs that seek to describe reality. Surveys are used to understand the reality of community members who witnessed an incident. It is important to establish that surveys and questionnaires are not synonymous. A survey is a general methodology for gathering, describing, and explaining information from sample(s) to construct a quantitative description of a population (Slattery *et al.*, 2011).

Thirty-eight questions were included in the survey, thirty-seven of which were multiple choice, and one question open ended. The multiple-choice questions (Appendix 1) were scaled differently; some have a rating of 1 to 9, questions included, gender, schooling, the number of year's community members have lived in Masiphumelele, type of dwelling and the methods that are used to generate heat as a primary source.

The researcher first had a meeting with community leaders and the head of the fire-fighting department to plan how data could be collected from the research targeted area. This meeting also emphasized the goal of the research, the gathering of secondary data such as reports, minutes, and fire incident complaints reports.

The research commenced in Masiphumelele after approval was obtained from the Disaster Management Director, University of Free State ethics committee and community leaders. Two research assistants (1 male and 1 female) proficient in Afrikaans, English and IsiXhosa (these are the most spoken languages in the study area) language were used to conduct the interviews. The research assistants first underwent some training on how to hold interviews. In the same

vein, they also participated in the translation of the questionnaire into vernacular. Eighty individuals were selected to participate in the research.

Before the final data was gathered, the data gathering tools were first pre-tested to detect weaknesses in them that needed the team's immediate attention. The researcher sought informed consent from the respondents to partake in the research. Additionally, respondents were assured that this research was for academic purposes, and they were free to pullout of the research as and when they liked. These research ethics among others were outlined during debriefing sessions.

Although not many problems were experienced with the fieldwork, some are worth mentioning. It was difficult to gather informal sector residents for discussions and interviews. This is because most of the time they were busy doing some personal income generating activities and found it difficult to forego these activities.

3.2.2.2 Questionnaires

Questionnaires refer to a specific tool for gathering information. Questionnaires are also known as scales when their assessment creates a quantified score or a series of questions and are usually self-administered. The questions contain specific concepts of interest or items deemed worthy of investigation and can be disseminated in a variety of ways, including mail, internet, or even read to participants (Slattery *et al.*, 2011). Questionnaires (Appendix 2) were issued to Masiphumelele community members.

The use of questionnaires aided in getting objective views from the public and responding agencies who were involved in the incident. Questionnaires were used to guide interviews with a structured set of questions for first responders and a separate set of items for survivors who were affected by the Masiphumelele informal settlement fire on November 29, 2015. The researcher used research assistants, who translated the questions into vernacular language when it was necessary and were familiar with the area. Before data was collected from the respondents, the study was explained to inform all individuals what the investigation entailed and to seek their consent. The questionnaire comprised 24 questions divided into the following sections:

- Section 1: Questions relating to the demographics of the residents in Masiphumelele.
- Section 2: Questions relating to the type of shelter resident's use.
- Section 3: This section deals with the response to the incident from the community member's point of view.
- Section 4: Questions relating the preparedness of the community member's.

3.2.2.3 Key informant interviews (KII)

Rowley (2012) argues that interviews are generally used in conducting qualitative research, in which the researcher is interested in collecting facts, or gaining insights into or understanding of opinions, attitudes, experiences, processes, behaviours or predictions. Interviews were held, with key informants such as community leaders, fire fighters and SAPS officers. Key informants were heads of the first responder agencies. The key informant interviews were loosely structured conversations with those who have specialised knowledge in first response and their field. The interviews gave the researcher more depth and understanding of the topic, and this resulted in the discovery of information that did not form part of the questionnaires. The KII tool contained 17 questions. Appendix 2 shows the questions that were in the KII.

3.2.2.4 Observation

The observation tool was included as one of the data collection methods in this research. Flyvbjerg (2006), states that there are more discoveries stemming from the type of intense observation made possible by a case study than from statistics applied to large groups. The researcher has responded to numerous informal settlement fires with the City's Fire and Rescue services and additionally also responded to fires in Masiphumelele. The researcher was aware of the challenges faced by emergency responders.

Observations assisted with the identification of relevant variables, which were the source of most preliminary information. The advantage of representation is that it gives richness and delicacy that no other method can provide (Wimmer & Dominick, 2008). The researcher spent a five days at Fishoek fire station to

observe the response to various incidents. This included the observation and listening to some of the emergency calls received as well as how emergency response is activated. The researcher noted the call conversations in form of notes to use information as complementary information to other data collection methods. Unfortunately, due to ethical reasons, the researcher could not record the emergency calls.

3.2.2.5 Secondary data

The Masiphumelele incident was well covered by local media, internet news, printed newspaper articles and internet blogs that included Times Live, News 24 and the Cape Argus. This coverage was due to the ongoing informal settlement fire problems in Cape Town, as well as current land claims, which occurred in Cape Town. Informal settlements incidents highlighted the need for more land and proper housing. Cape Town has been under political strive and every incident is used as an opportunity for political parties to blame each other via the media for political gain. Therefore, the numerous media sources that covered the incident were valuable resources while gathering information about the incident.

3.3 Data analysis

Data from questionnaires was cleaned through re-reading to identify null responses and inappropriate responses that did not add value to the study. Through this exercise, no questionnaires were rejected as all information captured was found useful. The researcher created a grid in the excel worksheet to capture responses based on each respondent. Non-numerical data was coded whereas numerical data was captured as is. Data analysis was accomplished using the Statistical Package for the Social Sciences SPSS) version 27.0. Descriptive statistics and trend analyses were used to draw out conclusions on questionnaire data. Secondary data and data gathered from documents and observation was used to complement descriptive data to produce conclusions through explanation building.

3.4 Sampling

3.4.1 Population of the study

Masiphumelele is a Xhosa word, which translates to ‘let us succeed’. This settlement is situated about 40 km south of Cape Town. The only census

available for this study is the 2011 census survey. It stated that at that particular time, Masiphumelele consisted of a population of approximately 16000 people with around 5000 households (Stats, 2011). Furthermore, the community consists of 53% males and 47% of females, (Stats, 2011). The study used purposive sampling methodology to engage 80 research respondents from the targeted community.

The City of Cape Town's fire and rescue services consist of 30 fire stations (City of Cape Town, 2017). Fishoek fire station deals with all types of fires, rescues and emergencies within its designated area, which includes Masiphumelele informal settlement (Figure 1.1). At the time of the study, Fishoek fire station had one fire engine, one water tanker and one skid unit with nine fire fighters operating the station on a three-shift system. It has a large, designated area with one fire station, which is situated 4.8 km from Masiphumelele (Figure 1. 2). The Fishoek fire fighting team consists of 98% male and 2% female team members (Everts, 2017).

3.4.2 Sampling method

Byrne (2001) states that judgement sample, also known as purposeful sample, is the most common sampling technique. The researcher actively selected the most knowledgeable sample to answer the research question.

Silverman (2010) describes purposive sampling as a method where respondents are selected based on the groups that the research addresses. Researchers may implicitly choose a representative sample to suit their needs, or specifically approach individuals with certain characteristics. The media when canvassing the public for opinions and in qualitative research often use this approach.

In the backdrop of the above, the research selected 12 key informants (6 female and 6 male) service provider employee, namely from Cape Town City Fire, South African Police Services and Ambulance Services. Additionally, a minimum sample size of 80 respondents' fifty-eight (58) men and twenty-two (22) females, from the residents in site C Masiphumelele was used. Site C was the main area affected by the fire. Researchers seldom survey the entire population. Sampling is used because it costs less and requires less time during the research. The three distinct advantages of sampling are faster data collection time, lower price, as well as the quality and accuracy of data (Ifunanya, 2010).

3.4.3 Sample frame

This study focused on the Masiphumelele incident, which occurred on November 29, 2015, in Fishoek, Cape Town. The sample of respondents was drawn from agencies who responded to this incident which are the South African Police Service, Metro Ambulance services, and Fire & Rescue (City of Cape Town, 2015). The study also sampled some residents of Masiphumelele, aged eighteen to sixty-five. Respondents included individuals from all educational and socio-economic statuses; emergency responders who were involved in the incident also formed part of the respondents.

3.4.4 Response rate

3.4.4.1 Questionnaires

Eighty questionnaires were administered. Eighty questionnaires were delivered to Masiphumelele and twenty to first responders from the organisations who attended to the incident leading to a 100% response rate. The respondents were 58 men and 22 women

3.4.4.2 Key informant interviews

Twelve key informant interviews were held with personnel from emergency response agencies, namely Cape Town City Fire and Rescue (2 male and 2 female), South African Police Services (2 male and 2 female) and Ambulance Services (2 male and 2 female). These interviews were held individually so as to avoid ‘cross-sharing’ of responses which would compromise data quality.

3.4.4.3 Observations

The research conducted observations over two days (from 8:00am to 4:00pm) visits to Fishoek Fire and Rescue Station. The researcher observed, listen to and took notes of emergency phone calls, which triggered fire and rescue personnel’s respond to emergencies in targeted communities. The researcher also observed how they coordinated with other emergency response services providers such as SAPS and Ambulance Services.

3.5 Conclusion

The researcher opted for a case study research methodology because of its associated advantages. A case study method ensures an intensive study of a unit or area of study. It is the investigation and exploration of an event thoroughly and deeply. As a result, a case study helps one to get a detailed and in-depth study of a person, event or incident. This is the case with incidents that cannot be physically recreated e.g. the fire outbreak that happened in Masiphumelele. The research used a combination of quantitative (questionnaires), qualitative (KII, observations) and reference of secondary data and reports. Data gathered through quantitative tools was analysed using SPSS. This was triangulated with qualitative data and secondary data, thereby solidifying research reliability and validity.

CHAPTER 4: DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1 Introduction

This chapter presents the results of the research conducted with respondents from Masiphumelele informal settlement. Questionnaires were administered to Masiphumelele residents who were affected and or witnessed the Masiphumelele incident. This was followed by key informant interviews with staff from emergency response agencies. Additionally, the researcher spent two days at Fishoek's fire station to observe their response to incidents. Quantitative data was analysed using SPSS. The results in this chapter are presented in such a manner as to be consistent with the research objectives and questions identified during this study.

4.2 Demographic information

A demographic overview is necessary to attain a better age, gender and academic profile of the respondents of the case study. Table 4.1 provides an overview of the age, average number of respondents who were affected by the fire outbreak, and those who witnessed the fire outbreak.

4.2.1 Age in years

Table 4.1 Average age distribution of respondents

Age		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21 - 25	12	15.0	15.0	15.0
	26 - 35	32	40.0	40.0	55.0
	36 - 45	30	37.5	37.5	92.5
	46 - 55	6	7.5	7.5	100.0
	Total	80	100.0	100.0	

The age distribution of respondents showed that most of the individuals were aged between 26 to 45 years. This age group also suggested that there is a high unemployment rate among young individuals due to them being at home during the distribution of the questionnaires. Furthermore, this indicated that most of the individuals affected by the incident were between 26 to 45 years old.

4.2.2 Gender distribution

This section profiles the respondents to the 80 questionnaires were delivered to Masiphumelele. Twenty key informants from emergency response agencies who attended to the incident were interviewed. Table 4.2 presents the results.

Table 4.2 Gender distribution of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	58	72.5	72.5	72.5
	Female	22	27.5	27.5	100.0
	Total	80	100.0	100.0	

Fifty-eight (58) men and twenty-two (22) women responded from Masiphumelele community. The majority of respondents were men, as they were readily available to do so.

4.2.3 Education levels

Education sustains overall development and enhances employment opportunities. It gives people a better opportunity for a fulfilled life. A community's level of education influences their welfare (Western Cape, 2016). Table 4.3 presents the results.

Table 4.3 Academic levels attained by respondents disaggregated by gender

		Highest level of education			
Gender		No schooling	Grade 11 – 12 (Senior Secondary)	University, College, Technicon (Higher Education)	Total
	Male	3	48	7	58
	Female	3	15	4	22
Total		6	63	11	80

Eleven respondents (7 male and 4 female) indicated that they hold higher education qualifications of which the majority, 63 respondents (48 male and 15 females) indicated that they hold senior secondary qualifications. The level of education determines literacy levels, which is directly proportional to poverty and vulnerability (Western Cape, 2016). To design a community's risk survey or fire safety plans, it is essential to know which medium of communication is most

efficient. In this case, charts with words would have been ineffective as the community has low education levels (Community toolbox, 2018).

The City's fire prevention team has many ways of communicating fire safety material and mostly use pictographs charts when communicating fire safety and prevention in Masiphumelele (Everts, 2015).

4.3 Residency in Masiphumelele

This section addresses issues to do with the length of residency in this informal settlement. It further addresses the type of dwellings and materials used to build the structures as well as the source of heating. The approach followed the questions, which were detailed in the questionnaire. The attributes were investigated to get an in-depth understanding of their contribution to this disaster.

4.3.1 How long have you been a resident of Site 5, Masiphumelele?

The length of residency determines the responses and magnitude of impact of the disaster on individuals. The results indicated that 79% of the respondents had been residents of Masiphumelele for more than five years. 19% had been residents for between three and four years, and 2% had been residents for less than two years. These results indicated that most of the population was present during the incident in Masiphumelele.

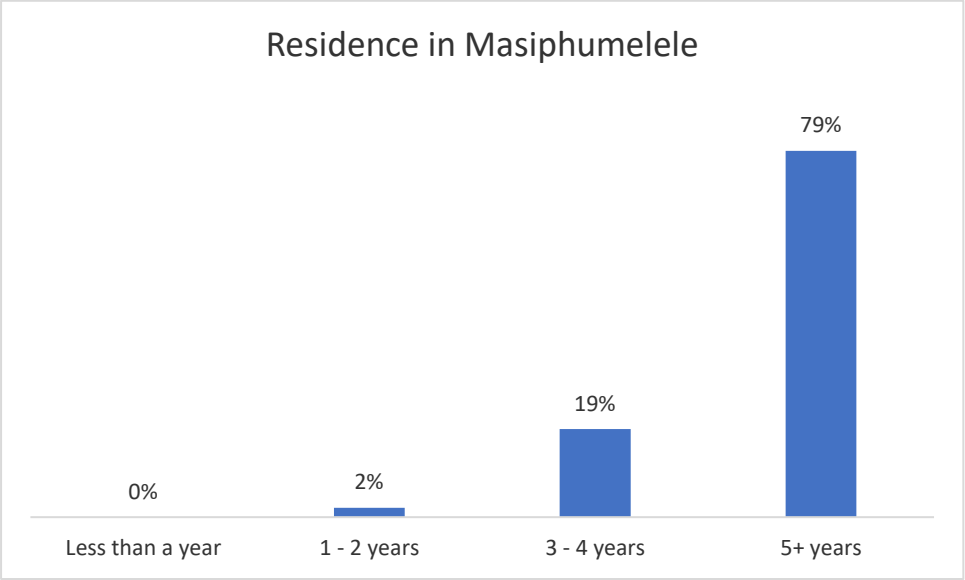

Figure 4.1: Period of residency in Site 5, Masiphumelele

4.3.2 What is the type of ownership of the dwelling you live in?

The housing status of a community refers to the adequacy of the houses. Inadequate housing refers to overcrowded dwellings, informal backyard shacks, and informal dwellings (Western Cape, 2016).

At the time of this study, most of the residents (67%) had their own structures or houses. Thirty percent of the population were sharing a living space by renting from those who had their own houses or structures. These structures were made from wood and iron on the same property as the owners, with limited space in-between the structures. The remaining 3% were living with their families. Figure 4.2 presents results.

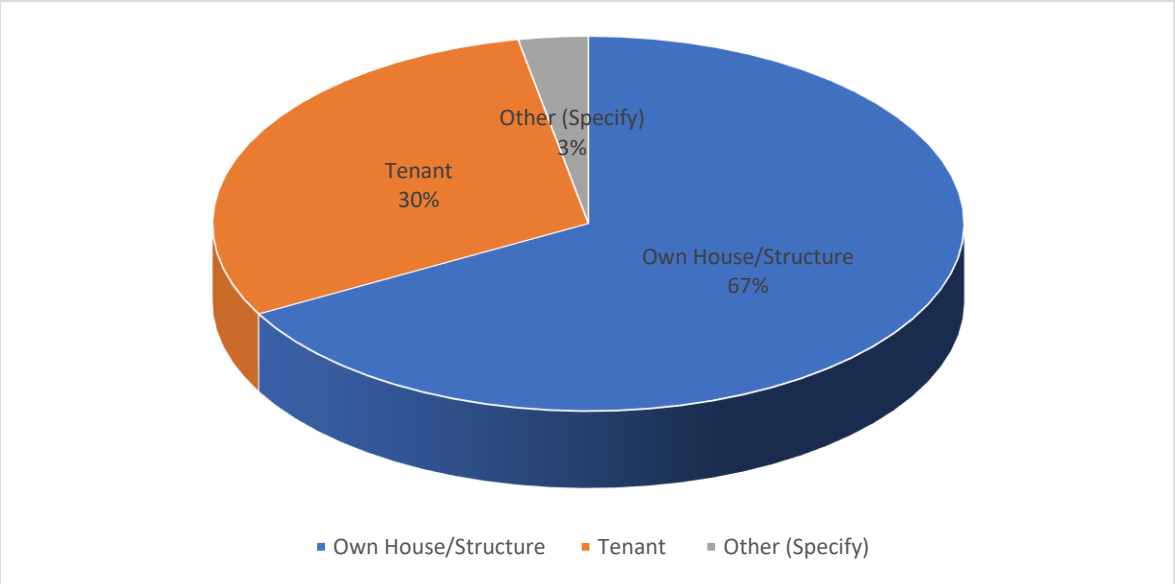

Figure 4.2: Type of structure and its ownership

The highest percentage comprised owner-owned structures. However, this does not imply that these were legal structures as it was further unearthed in the question that asked about the type of material used.

4.3.3 Type of material

Informal dwellings are defined in the 2011 Census metadata as illegal makeshift structures that are not intended as permanent dwellings. These structures are usually built with materials such as plastic, corrugated iron, and cardboard. According to the 2011 Census, 81% of the City of Cape Town's dwellings were constructed using formal or conventional materials, while about 10% of the households lived in traditional, informal and other dwellings. Access to formal dwellings has increased from 837 532 dwellings in 2011 to 1 032 497 dwellings in 2016. Across the Western province, access has increased by approximately twenty-one percent over the same period (Stats, 2012).

The materials used to build these structures or houses consisted of wood and iron for 18 respondents (13 male and 5 female), while 42 respondents (30 male and 12 female) indicated that they used other materials such as plastic sheets and cardboard boxes, which are highly flammable. This contributed to the quick spread of the fire across the community and the gross damage that resulted from the disaster. Demographically, 75% of those who indicated that their houses were

built of brick are men and 25% women. Table 4.4 indicates the type of materials used to build these structures disaggregated by gender.

Table 4.4 Type of material of housing structure disaggregated by gender

		What type of material does your dwelling consist of?			
		Bricks	Wood and Iron	Other (Specify)	Total
	Male	15	13	30	58
	Female	5	5	12	22
Total		20	18	42	80

It can be noted from this table, as stated previously, that most of the structures were built using other materials such as plastics, cardboard boxes, ceiling boards and wood. The use of these types of materials among other poorly designed structures exacerbated the situation. It was noted that most female respondents stayed in structures made of other materials that are highly inflammable, thereby posing a higher risk of endangering their lives as compared to men.

4.3.4 Sources of heating

Access to electricity in the City of Cape Town increased by 23% between 2011 and 2016, yet 5 857 households were still using other sources of heating and 22 992 households had no electricity during the previous Census 2011 (Stats, 2012).

The three primary sources of heat, as found during this study were electricity (37%), paraffin (42%) and gas (21%). Most people used paraffin for cooking and heating, while thirty-seven percent used electricity. This study highlighted that hazardous conditions and living environments contributed to unsafe situations. Many sub-urban and rural settlements contained hazardous electrical connections with wires dangerously hanging from structure to structure. Lack of access to electricity in some regions of the community led to illegal and extremely dangerous electrical connections, which communities do alone without guidance or certification of a qualified electrician. Figure 4.3 presents the results.

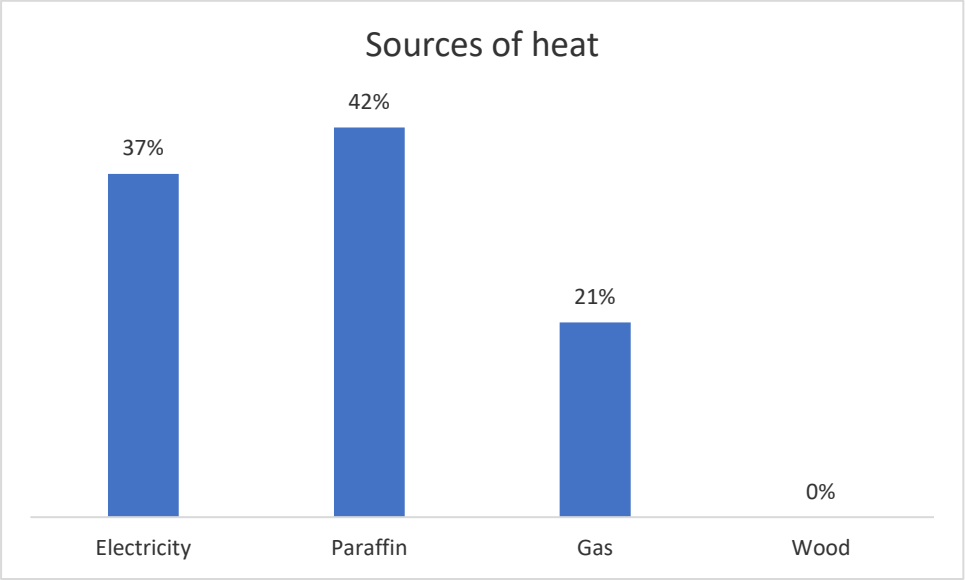

Figure 4.3: Source of heating

Illegal connections, extending from legal connections were observed in Masiphumelele. According to the key informant interviews, it was noted that even though a property had access to electricity and electric distribution board, there were still individuals and groups who continued using other sources of heating, such as paraffin or gas. The reason for this was the affordability of paraffin and gas. In some cases, the landlords who installed prepaid electricity meters did not include this resource in the renting price.

The key informants and secondary data also highlighted that the other reason for the continuous use of other resources might include time consumption. The population of the informal settlement made use of public transport for commuting. This meant leaving home early in the morning and arriving late in the evening. Appliances that use electricity take time to warm up, that is, geysers, kettles, heaters, ovens and stoves. Individuals consequently reverted to using gas and fire as it is perceived to be faster than electricity.

4.4 Knowledge about disaster response mechanisms.

This section presents results from community members regarding their perception of the disaster. It reports on the effects suffered by individuals, knowledge about emergency response action to be taken, and how to contact the emergency services. The understanding of the community's responsibility in an

emergency is also assessed. Graphical presentations of the findings are presented in Appendix 4.

4.4.1 Negative impact of the fire that occurred on November 29, 2015

Informal settlements are the ideal cost-saving solution for those that cannot afford houses close to the cities. These settlements are usually occupied because of affordability and proximity to work areas.

Through interviews, it was established that the disaster affected the whole community. The effect was on physical aspects and on the aftermath of the disaster. Although the victims and respondents are fully aware of the impending disastrous conditions of their living environment, and the dangers caused by illegal sources of heating and powering of their homes, they continue with this way of living. Reasons put across were, that they are used to it and that is what they can afford.

Survivors who escaped the fire without injuries were traumatised and live-in constant fear of losing their homes or even lives, daily. The trauma was also transferred from one household to the next as the members who were left without homes, work, or any personal belongings, were forced to live with family or neighbours. The above-mentioned again placed an economic strain on other families and/or neighbours as the latter were caring and catering for other community members who had nowhere to go.

Secondary data observers commented that physical injuries were not attended to adequately due to these survivors not having medical aid and transport to and from more specialised care facilities.

4.4.2 Distance to the nearest fire/rescue station

The City of Cape Town's Fire brigade has 35 fire stations across the Peninsula and deals with various emergencies, fires and rescues. The fire station in Fishoek (nearest to Masiphumelele) provides an effective and efficient service to residents and visitors alike (City of Cape Town, 2019).

It was observed that the Fishoek fire station was the nearest station to Masiphumelele. This fire station has one fire pump with an extensive designated coverage or responding area. The results indicated that fire fighters had to travel

for about 4.8 kilometres to get to the incident. However, due to unplanned and overcrowded road networks in informal settlement, the fire fighter struggled to access the fire incident scene on time..

The researcher observed that Masiphumelele is designed in a colony pattern, which means that a fire spreads quickly and easily from one shelter to the next. Although there were multiple fire stations that came to assist, the situation could have been improved if these informal settlements had adequate access to running water, to enable residents to start extinguishing the fire on their own.

Key informants indicated that another resource that would also assist the fire fighters, as well as the occupants, is to have portable fire extinguishers in their shacks. This can ensure the curbing of the spread of fires to a certain extent, until the fire fighters and rescue teams arrive on the scene.

According to the incident report (F1511/3853, Appendix 4), the furthest response was from Brackenfell fire station, which is 62 kilometres away from Masiphumelele. The solution might not be as simple as erecting more fire stations closer to these settlements since it would take years to develop. However, a solution that might better suit and assist these communities would be to enable and equip the community members to help themselves.

Fire stations should have regular training programmes meant to educate the settlers on safety hazards of illegal connections and sources of heating and power. The community needs to know the time it is likely to take emergency responders to get to them in the case of such a fire. This will help community members to be aware of how long it can take to save a life. This places a collective responsibility on communities as well as the various fire departments, if there is a greater awareness of the hazards resulting in fire disasters.

4.4.3 Agencies attending to the incident

According to the official fire and rescue incident report, more fire and rescue personnel attended the scene than officials from other agencies. These emergency responders were deployed from fire and rescue services. Metro ambulance and disaster management accounted for 10% representation during the blaze. Other proportions of agencies are presented in figure 4.4 below.

According to disaster relief reporters, there were a total of sixty-five fire fighters and emergency personnel, as well as fourteen fire-fighting vehicles. This was recorded when the fire was brought under control.

The above-mentioned excludes the help received from Table Mountain National Parks, bystanders, and other city departments such as the Department of Human Settlements, Disaster Risk Management, Department of Solid Waste and the South African Red Cross who assisted on the scene to co-ordinate relief efforts.

The City also offered relocation services and provided temporary relief. Local news stations also encouraged members of the community to donate goods that could assist the 4000 displaced people. Additional labour included Non-Governmental Organisations (NGOs) who assisted with living arrangements and counselling for the victims.

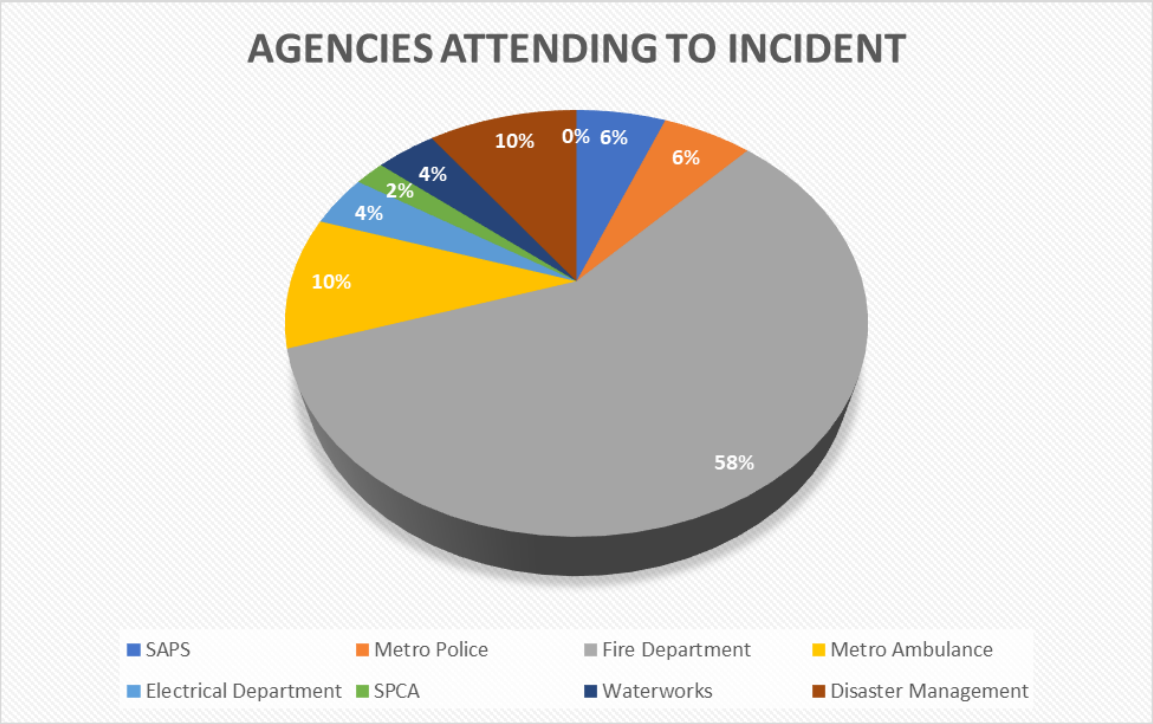

Figure 4.4: Agencies attending to the incident.

4.4.4 How was emergency response service agencies notified of the incident?

Resilient warning tools and public alert systems are essential to save lives and property during emergencies. A emergency alert system (EAS) can be used to

alert first responders via cable satellite, broadcast, and wireline communication pathway (Safety and Security, 2018).

The City of Cape Town has cameras in areas identified as high-risk that are monitored from the main control centre in Goodwood. Incidents are therefore, reported via the camera. In other areas, first responder response is dependent on a person alerting the fire department (Everts, 2018). Emergency services require a notification via a telephonic call that there is an emergency. In many instances, victims of an emergency assume that someone else involved in the emergency, has already notified the emergency services. This, however, should not be the assumption in an emergency.

Eighty-four percent of respondents were sure that emergency services were notified via telephone while 11% did not know if the emergency was reported. Five percent of the respondents indicated that someone was sent to the fire station. This was unnecessary as these community members could have assisted others in getting to safety instead of wasting time going to the fire station. The 11% who indicated they did not know whether the emergency services were notified or how they were notified is a cause for concern. An appropriate system should be put in place to ensure that all community members or members of an informal settlement are aware when emergency services have been notified. This would allow them to continue dealing with smaller fire outbreaks that can be extinguished by means of water and small fire extinguishers. It will also allow the emergency call lines to stay clear in case of another emergency elsewhere.

When people know help is on the way, they might find it easier to focus on what they can salvage instead of being caught up in the chaos. Too many people working towards the same goal (notifying emergency services) means that too few people were assisting those who could not help themselves (children and the elderly).

4.4.5 Knowledge of the fire and rescue toll-free emergency number

The City of Cape Town implemented a toll-free emergency number for residents in Cape Town. When the number is dialled from a landline, the emergency centre identifies the telephone number calling and the area of jurisdiction. The emergency then directs the call to the relevant authorities or responders (City of

Cape Town, 2019). When calling from a cellular phone, also a toll-free number will direct people to the relevant service needed.

The reporting number the communities depend on during an emergency is vital, as calling the wrong number causes a delay in response to the incident. Forty-three percent of the respondents identified 10111 as the number to call in case of a fire related emergency. However, this number is for those in need of police assistance. Only 3% positively identified 10177 as the number for a medical or fire emergency. The number that can be called free of charge from any landline for assistance when faced with any emergency, whether it be medical, fire, traffic, accident, and crime-related is 107, which was identified by 20% of the respondents. The number 112 and 021 480 7700 from a cellular phone enables individuals to call for assistance when faced with any emergency, whether it be medical, fire, traffic, accident, and crime related (The South African, 2018). Figure 4.4 below shows proportions of numbers with regards to emergency numbers.

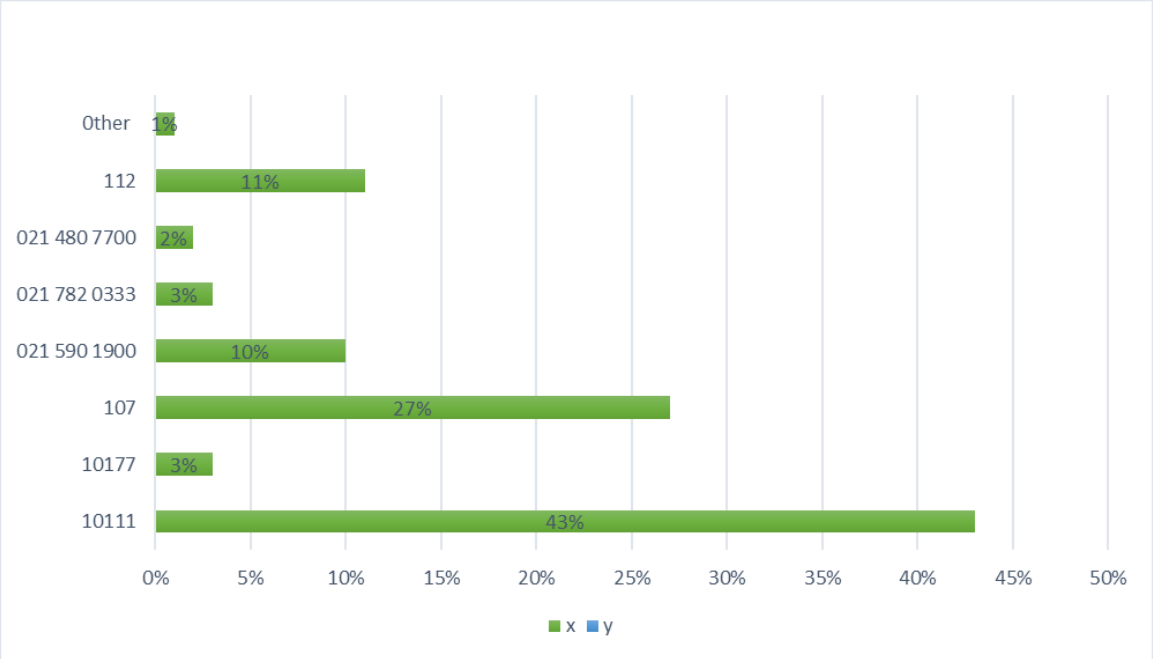

Figure: 4.5 Accessibility to the fire site by emergency services agencies

The road conditions, the distance between the settlement and the roads, and accessibility of the informal settlement to fire engines also contributes to delays in fire fighting. Attempts by people to save their valuables also delays fire-fighting activities. Beds, televisions, cabinets, and other furniture were carried out and put

in roadways, blocking or delaying access for fire fighting vehicles (Ngau and Boit, 2020).

According to Everts (2015), access to fires is a significant challenge when fighting informal settlement fires. People attempt to salvage what is left of their personal belongings by carrying them out of the burning structures and placing them in the roadway. First responders responding to the Masiphumelele incident had the same challenge. By the time fire fighters realised that the roadway was blocked, they had to exit their vehicles to clear the road of blockage, which exposed the emergency responders to other external hazards.

When a fire engine must make a detour, it is not as simple as turning a car around and this again delays the response to the actual emergency. Only once the fire fighters have found a suitable route and space for the fire engine to be parked for the water pumps to be utilised, can they start assessing the scene. This causes a significant delay and could possibly cost lives because of inadequate knowledge of action during an emergency in the informal settlements.

According to the results shown in Figure 4.6, 50% of responders and residents strongly disagreed that there was immediate access to the fire. Fourteen percent agreed, 10% were neutral and 10% disagreed, while 16% claimed that there was enough access on roadways for fire fighting vehicles to start immediate firefighting. Even though the results show that community members knew that access to the fire was obstructed, there were still individuals who denied that access and firefighting efforts were hampered. Thirty-four percent did not respond to this question.

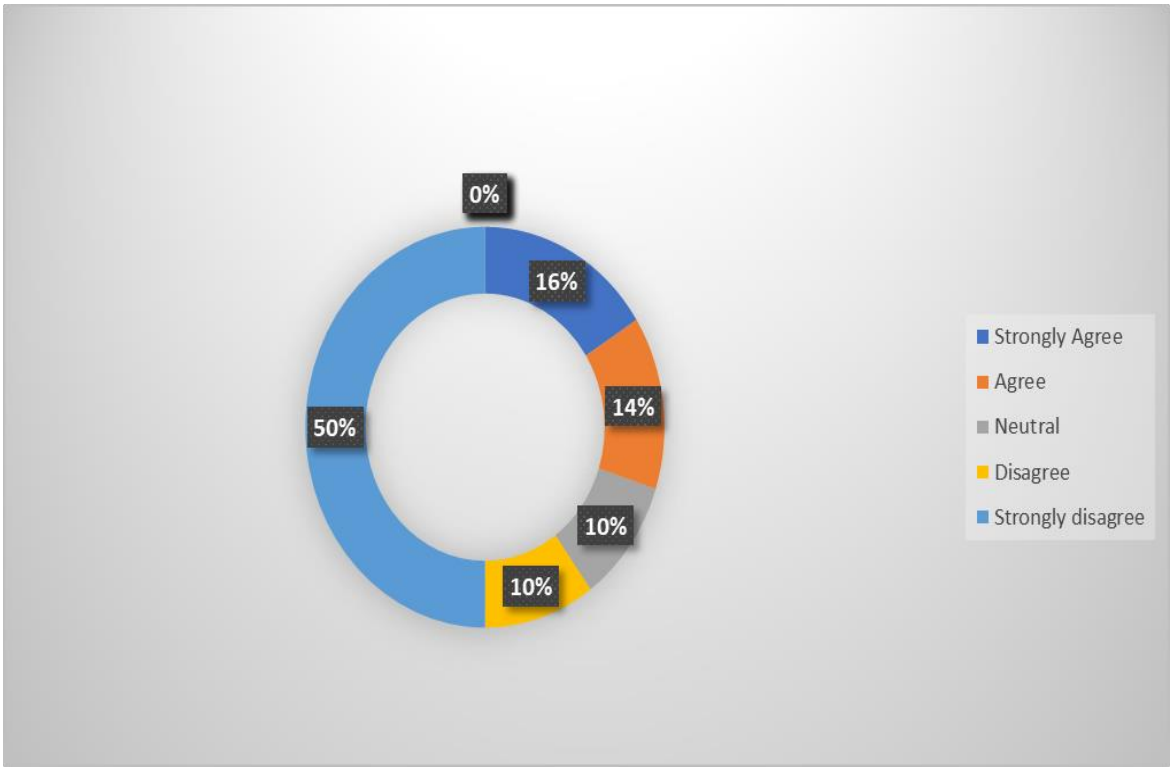

Figure 4.6: Emergency services had no problem getting access to the burning dwellings.

To improve the effectiveness of the fire fighters responding to such an emergency largely depends on external factors and the knowledge of the community members directly affected by the emergency. To improve knowledge and response time, one needs to educate and inform the vulnerable members of the community just how much of an impact their actions have on them being rescued during such a massive emergency.

4.4.6 Accessibility of fire hydrants and water by emergency services

When fire fighters arrive with their apparatus, they need to position their vehicles as close as possible to the location of the incident to be most efficient. Where apparatus access ends, fire fighters must then carry equipment to the location of the fire and emergency site. This means additional time and effort spent on collecting apparatus, equipment and resources, which results in a delay of fire attack and the actual emergency services being delivered.

Apart from fire fighters have the burden of carrying heavy equipment; they also need to be aware of the surrounding terrain, which may not be the easiest to

manoeuvre when it comes to informal settlements. When fire fighters are aware of the rough terrain, they need to plan to ensure that all the necessary equipment and resources reach the site of the fire as soon as possible to avoid making multiple hazardous trips to the fire trucks and even more time delays.

Access to water at the informal settlements is also another challenge as hydrants are often damaged or have structures built on them. In most cases, fire fighters spend time setting up hose lines due to hydrants near the fire being damaged. Where possible, fire fighters attempt to undo the structures built on the hydrants. However, this also has its own dangers, such as the collapse of a structure and injuries occurring during such an attempt. The community member, whose illegal structure must be demolished to access the fire hydrant can also resist. Fire trucks have installed water pumps and carry pre-connected hose-lines but these lines are limited due to their fixed length. In the case of Masiphumelele settlement, access to fire hydrants and water was hindered by closely built structures, vandalised hydrants and buried hydrants.

4.4.8 Assistance rendered to victims by disaster management or NGO's during and after the fire

The effects of the disaster left many community members helpless and shattered. The damage varied from injuries, death, property damage, poverty, infrastructure damage, sanitation outbreaks and diseases. Many NGOs assist communities long after a disaster has dissipated (South African Red Cross Society, 2019).

According to the City of Cape Town, Masiphumelele residents were supplied with all the necessary relief aid. The disaster management centre carried out an assessment on the incident and activated their NGO partners who provided shelter; food parcels and blankets (City of Cape Town, 2015). The Human Settlement Department provided victims with starter kits to rebuild their dwellings (Hundreds homeless after fire tears through Cape informal settlement, 2015). When residents were asked about NGO involvement during and after the incident, 70% of the respondents agreed that NGOs, like Gift of the Givers, assisted the residents with blankets, food, and the City of Cape Town provided them with starter kits to rebuild their structures. A further 27% was neutral as they were not sure who the people were who assisted them, while 3% did not respond. Those who indicated uncertainty about who assisted them during their

time of need is an indicator that NGOs need to arrange information sessions to inform vulnerable community members of who can and will assist them, should they find themselves in a hopeless situation. Assistance was available even though those involved might have been unaware thereof. This also indicated that the work these NGOs do goes unnoticed, despite them playing a vital role in the recovery process after such a disaster.

4.5 Disaster preparedness of community members

This section describes the status of emergency preparedness by community members in Masiphumelele settlement. It explores the presence of a fire committee, drill practices, information dissemination, and ownership of firefighting equipment, ownership of primary healthcare equipment, knowledge of exit points, and knowledge of assembly points. Graphical presentations of the findings are presented in Appendix 3.

4.5.1 Existence of informal settlement fire committee in Masiphumelele

Local committees assist the fire department to build resilience in communities by notifying the fire department about community risks, needs and priorities. Local communities help local voices to be heard and considered, particularly relating to their risks and needs. They also ensure a mechanism for influential local voices in the fire department planning.

In this study, 97% of the respondents had no knowledge of a fire committee and 3% professed to have little knowledge on that. This result indicated how much of a need there is for such a committee to be established and for the responsible persons to convey the shared knowledge with other members of the community. When community members become actively involved in emergency programmes, it allows them to become responsible for their own actions and think about the consequences specific actions might cause. A community response programme teaches volunteers about disaster preparedness and prepares them on how to mitigate and respond to hazards that impact their area. This training may include necessary response skills like basic search and rescue, fire safety, medical response, and team organisations (Fire and Emergency: New Zealand, 2017).

4.5.2 Access to emergency fire preparedness information by community members

To get any fire-related information, there should be a designated department, unit or person responsible for emergency preparedness. Most local governments that respond to disasters in their designated areas comply with the federal request to post these events online or in places where the public can access the information. Plans can then be made according to best practices when different disaster response strategies are compared.

It was established that more than half of the Masiphumelele community had no idea where to find any information related to fire preparedness or that such a department even existed (Figure 4.5.2). Since this is a vast informal settlement, it should have a department that informs community members about fires and related queries. Seven percent of the residents reported that they became aware of the existence of such a department via television or radio stations.

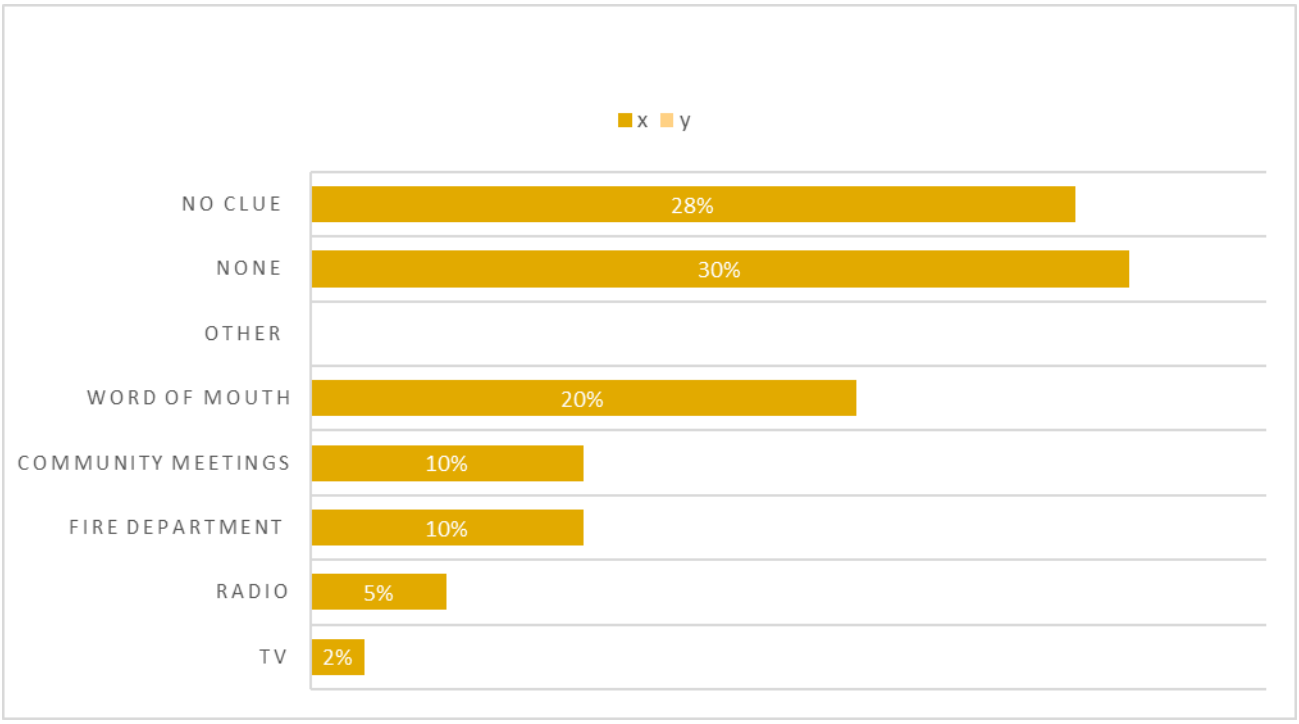

Figure 4.5.2: How are you receiving fire information in your area?

4.5.3 Knowledge and availability of emergency exit routes/points in Masiphumelele

The City of Cape Town's Disaster emergency guidelines for families' states that to prepare for a fire disaster, one must identify two exits out of every room and keep exits clear. Exit routes should be planned and discussed with family and friends and different routes should be identified to get to the meeting point. Each family member should have a copy of the emergency plan (City of Cape Town, 2019).

Even though members of the Masiphumelele community indicated that they are aware of the emergency exits, these did not comply with the Family's Disaster Preparedness Plan. Most shacks only had one exit and entrance, and roads leading in and out of these areas were minimal.

4.5.4 Existence of fire assembly points in Masiphumelele

Emergency assembly points are designated areas in or just outside of the settlement, which offers a place of safety in an emergency. People can safely gather at these points whilst waiting for information about the emergency (Santa Clara, 2018). Only three percent of the residents knew where to gather after exiting the location of the emergency. Not having knowledge of an assembly point (97% population) indicated the unpreparedness of the community.

4.5.5 Existence of a fire extinguisher at household level

The National Fire Protection Association (NFPA) states that fires can be extinguished by using a fire extinguisher correctly. Using a fire extinguisher can have a significant impact on reducing damages caused by the spread of fire. NFPA further states that for 80% of all fire-related incidents, a simple extinguisher was all that was needed to extinguish the fire (Fireline, 2017). Ninety-nine percent of residents in Masiphumelele indicated that they do not own or have access to a fire extinguisher.

4.5.6 Existence of a first aid kit at household level

A first aid kit is essential in every home as it enables individuals and family members to treat minor injuries and ailments that occur at home. Rendering immediate first aid can prevent minor injuries from escalating to severe forms of infections. These kits include a variety of items to treat cuts, burns, scrapes, muscular injuries and can be homemade.

According to the findings of this study, 96% of the residents in Masiphumelele community did not have a first aid kit in their home or immediate environment. This is another indication of poor organisation when it comes to the health and safety of this community. Ownership of a first aid kit also indicates that the residents are taking responsibility and are planning for future events.

4.5.7 Participation in an emergency drill

Emergency drills are essential to ensure some competence and experience for when an actual emergency or disaster occurs. Drills provide opportunities to identify and correct shortcomings in a procedure, equipment or action. Rehearsing emergency drills ensures preparedness, and the repetition in training provides speed, which is also necessary for a disaster. The respondents in Masiphumelele at the time of study had not engaged in a drill.

Community members need to be educated and informed on a regular basis of the value of their lives and those around them to change their view of priorities in emergencies. Emergency services should arrange for community information sessions prior to the fire or flooding seasons commencing.

4.6 Key informant interviews with emergency response officials

The study further carried out KII with emergency responders. According to the findings, most of the emergency personnel were members of the Fire and rescue service. This means there is more manpower to handle an emergency than what is available for the prevention of the emergencies that could possibly take place. Thirty percent is equally divided between actual law enforcement and those who serve as community protection services, whilst only 10% of emergency personnel were members of the Metro ambulance services. This further indicated that all other ambulance services were rendered by and through private emergency

companies, leading to additional funds being spent on the health and safety of the community.

The incident was also attended to by other agencies such as non-governmental organisations, private companies, or government agencies set in place for specific disasters as detailed in Figure 4.6.

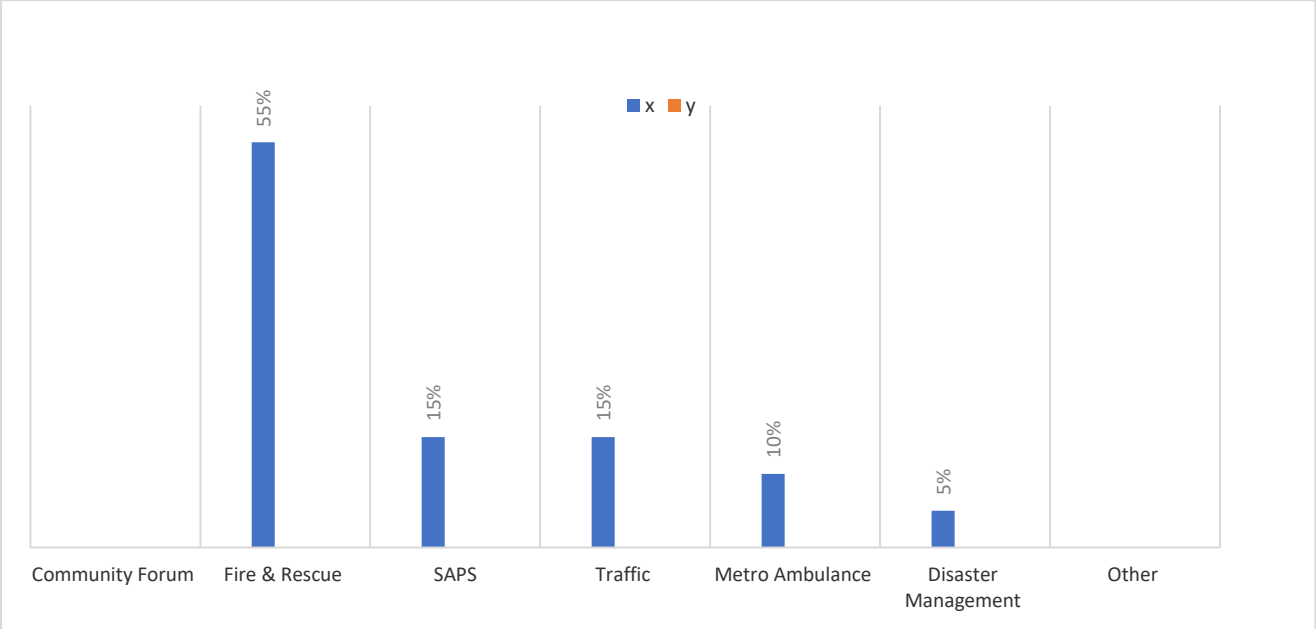

Figure 4.6.1: Which of the following agencies do you work for or form part of?

Most of the emergency responders indicated that they had worked for their agencies for over five years. Sixty-seven percent of the respondents indicated that the situation was dealt with and resolved in a timely manner. The majority of the respondents reported that the execution of activities and fire fighting was done adequately.

During the incident, 73% of the respondents indicated that there were sufficient resources to attend to the emergency. Access and availability of resources included items such as hoses and ladders, the resources needed to navigate to and from the scene, tools to ease and allow access to the site of emergency, as well as items that required to be carried to the scene due to roadways being obstructed by residents or debris. Most departments are equipped to deal with

these emergencies. However, it should not be overlooked that there is a shortage of fire and rescue departments near these informal settlements.

Based on the results, 60% of the emergency responders were satisfied with the agreement and mutual assistance delivered during the emergency. Results indicate that most people were not aware of the incident command system. This result leads to concern, as all individuals employed in emergency services should be knowledgeable in this regard.

4.7 Conclusion

This chapter outlined the findings of the study based on the Masiphumelele case study. The results indicate that the community has low levels of safety-related knowledge and safety responsibilities, as well as being at risk for future informal settlement fires. They were not prepared for fires, although it remains a common occurrence, thus resulting in significant losses, injuries and even deaths. The study revealed that the City of Cape Town's Fire and Rescue is well organised, resourced and has adopted international systems (Incident Command System) to deal with informal settlement fires. However, with informal settlements increasing, fire fighters must travel long distances to get to a fire incident as explained in the case study, the nearest fire response came from approximately 4.8 kilometres away.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarises the key findings, conclusions and recommendations that were highlighted in the study. This study focused on analysing the emergency response to Masiphumelele informal settlement fire incident, which took place on 29 November 2015 in Cape Town, South Africa. The study investigated the activation of a response and the handling of informal settlement fire hazards by exploring capabilities and challenges identified in this area by different governmental and non-government organisations and entities.

5.2 Summary of key findings

This section summarizes the preparedness of the community and the emergency responders to attend to the Masiphumelele fire outbreak. The chapter will further assess the emergency activities that were implemented during the day of the incident and thereafter. This will lead to unearthing the challenges that were experienced and explore how best the incident could have been handled.

5.2.1 Preparedness mechanisms in place to handle the Masiphumelele fire of 29 November 2015

The South African National Standard, Community Protection Against Fire (No, 2003) states that the main functions of a fire service agency is to protect life and property in case of fire outbreak. To accomplish these functions, the service needs to be well organised.

The City of Cape Town’s fire brigade is a professional Fire and Rescue Service with a rich history dating back to 1845. The City's fire brigade aims to provide a cost-effective, unprejudiced, equitable, and effective fire and rescue service to all visitors and residents of Cape Town. The city has 35 fire stations across the city, serving a population of three and a half million people in an area of 2600 square kilometers.

The fire service is divided into three geographical divisions, with more than a thousand and five-hundred employees, which includes fire and life safety staff, firefighters, fire-trainers, and support staff, command, and control staff. To prevent loss of life, property destruction, and to protect the environment from the

damaging effects of fire and other hazards, the city's fire service aims to sustain a safe environment for residents and visitors to the City.

Through key informant's interviews, it was noted that each fire station was minimally equipped with one fire truck and one water tender. Fishoek fire station was the station located nearest to Masiphumelele informal settlement, with approximately 10 kilometres. There were also provincial ambulances and disaster management agencies and resources in place that assisted the fire department.

5.2.2 The City of Cape Town's approach to shack fire response

The study established that the city's fire department implemented standard operating procedures whilst responding to these shack fires. The standard vehicle response is two fire trucks, one water tanker, and one rescue vehicle. Electrical Department, South African Police Service, Metro Ambulance, and Disaster management were notified as well. The fire department relayed information such as total shacks burned, total number of people injured, and of people displaced, to disaster management who arranged with NGOs for the supply of food, clothing, and shelter. Disaster management also assisted with rehabilitation by providing building material for damaged structures.

5.2.3 Assessment of emergency activities

The research assessed the emergency response activities of the city's fire and rescue services, whose aim is to minimise and prevent loss of lives, property and protection of the environment. This research notes that there are no community disaster preparedness plans that include community awareness and this increases the probability of occurrence of fires in the communities. This must be countered by fire and rescue staff capacity development and by supplying them with adequate equipment to respond to emergencies.

5.2.4 Analysis of how best the incident could have been handled

The call for the incident came at 00:21 am on the morning of 29 November. Findings indicate that most people were not aware of the number to call to reach the Fishoek fire station, so the fire would have been active for some time before the fire department received the call. The first fire vehicle, E49, responded from approximately 4.8, kilometres away, which was Fishoek fire station. Arrival time at the scene was recorded as 00:34 am on the morning of the incident. Support

vehicles were called in, with the furthest one having to travel 62 kilometres to the incident. The fire was extinguished after several hours using water. If there was a fire station in Masiphumelele, the damage would have been minimal.

The incident was dealt with by using the incident command system, and fire fighters were deployed strategically to contain and extinguish the fire. The fire department dealt with the incident using its standard operating procedures (SOP) for informal settlement fires. However, since it took them long to extinguish the fire, there is need to contextualise the SOPs to the context of densely populated settlement areas like Masiphumelele.

5.2 Challenges

5.2.1 Access to the fire

Obtaining access to the fire was a challenge. The entry into the fire zone was obstructed by a poor road network and poorly structured settlement with closely built houses and high population density. When the fire department arrived, they could not commence with fire fighting immediately as they first had to move residents' personal belongings of the road, as these residents carried out beds and furniture to salvage their belongings by placing it in the roadway.

5.2.2 Access to water

Another challenge was inadequate water to extinguish the fire at Masiphumelele informal settlement. The water pressure in the area was low. For a fire truck to operate optimally, they need at least 700kpa of water pressure. Hydrant's spindles were vandalised as they are made of copper or aluminium. The fire department was unable to get water from those hydrants. Seven water tenders were requested, as there were no operable hydrants in the immediate area.

5.2.3 Lack of knowledge on response activation mechanisms

A lack of knowledge on response activation mechanisms within the affected community was another challenge. People did not know how to activate an emergency response. The emergency response was activated telephonically by dialling Goodwood control centre, and this control centre dispatched the nearest available fire station.

5.2.4 Distance travelled

Another challenge was the distances that had to be travelled. The distance between Masiphumelele and the nearest responding fire station was approximately 4.8 kilometres and took the fire department approximately 13 minutes to reach the incident. Because of the time of call, it was assumed that there were no traffic issues while they were responding. It is the City of Cape Town's standard operating procedures to send two fire trucks immediately to an informal settlement fire. Fishoek station was despatched with the nearest supporting station located in Simons town, which was approximately 18 kilometres away from the incident.

5.2.5 Type of materials

The type of materials used to construct the dwellings in this area catalysed the spread of the fire. The building materials used to build informal structures were mostly wood and cast iron. Due to the shortage of space and trying to save on material and construction costs, these structures are built very close to each other. The primary source of heating inside these structures was paraffin. When one structure was set alight because of the material, space and wind, the fire spread to the other structures was rapid. Fifty shacks can easily set alight within minutes.

5.2.6 Lack of a disaster preparedness plan

The Masiphumelele community did not have a disaster preparedness plan tailor-made to their environment. In the same vein, there was dearth of information pertaining to how community members can help to avoid and respond to disasters at household and community level. This can be achieved by making use of The City's fire department fire life safety division, whose mandate is to introduce or share fire and life safety information with communities. Their information sessions typically take place at schools, and brochures are handed out with information on what to do and whom to call in an emergency.

5.3 Recommendations

The following recommendations are proposed from the study conducted in Masiphumelele informal settlement after the fire incident of 29 November 2015.

- Due to the distance between Masiphumelele and the nearest fire stations, there should be a fire station in close proximity or within the area. The area

has a high fire risk due to the shelter materials used and heating practices, which create even higher risk.

- Fire hydrants should be made of alternative materials instead of valuable metals, materials such as rigid plastic and hydrant covers should have locks that can be opened with a skeleton key, which can be stored on fire apparatus.
- Building materials should be painted with fire retardant paint to delay fire spread from one structure to another.
- Regular fire safety and prevention workshops and training should be held, and sessions should be advertised and broadcasted to ensure maximum attendance and representation of community members.
- Community members to volunteer as fire fighting and first aid support like that of community policing forums or reservists and their communities should know them.
- Emergency assembly points to be clearly identified per section and regularly inspected to ensure that structures are not built on top of it.
- Regular inspection of access roads to be done to ensure that they are cleared for emergency vehicles to reach the area requiring assistance within record time.
- Most people own cellular phones. An emergency app with GPS location that can be used for fires or any other emergencies can assist in rapid response activation. This app would eliminate confusion on whom to call in an emergency.
- Encouragement of communities to buy into having informal structures erected according to municipal regulations (at no cost to the community members) and with “safe space” in between the structures as well as the prescribed emergency exits, would save many lives and material losses. This would also prevent the breakdown of a structure that is built over a fire hydrant, etc.
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- Adhering to municipal regulations would also ease the service delivery to each of the sections in addition to adequate water supply to each area.
- Communities to take ownership of their own safety and protection of each other and the emergency equipment and personnel that enter the affected areas. Attacks on emergency personnel have increased over the last few years and responders are refusing to enter known high-risk areas without police escort.
- Ensure the availability of and affordability of electricity to combat illegal connections as well as limit the dependence of communities on gas and paraffin appliances.
- A red-light or siren could be fitted to the high lamp-poles that are erected in these informal settlements that could indicate that the emergency services have been called as well as serve the purpose of alerting others of the impending danger.
- Subsidised fire extinguishers to be supplied to each household that will be regularly checked and replaced and/or refilled, as with other formal structures and buildings.
- Two escape routes should be identified in each household. Where there is only one door, then a window can be used as an escape route. Bedding, curtains and other flammable materials should not be near open fires or cooking fire. All family members should know emergency numbers.

5.5 Conclusion

Emergency response needs to be activated through means of a person or device. Without response being activated, the fire department will not know about the incident. Response ownership relies on the person calling as soon an incident is witnessed and being informed regarding the contact details of the various response departments. A fire station is needed in Masiphumelele, and the hydrants in the area need to be serviced and repaired. The City of Cape Town's Fire and rescue is well resourced, and their standard operating procedures to deal with incidents are adopted from international systems and standards. These procedures comply with the National Fire Protection Association, which is an international body that

prescribes standards within a fire service. A strong relationship is needed to motivate communication and procedures between stakeholders. Furthermore, awareness of preventative measures to mitigate against informal settlement fires in Masiphumelele should be established.

CHAPTER 6: REFERENCES

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Appendix 1: Questionnaire administered to Masiphumelele.

ASSESSING EMERGENCY RESPONSE MANAGEMENT TO INFORMAL SETTLEMENT FIRES IN CAPE TOWN: A CASE STUDY OF SITE 5, NOVEMBER 29, 2015 MASIPHUMELELE, SHACK FIRE

Community Respondents

I am carrying out a study on Emergency Response Management to informal settlement fires in Cape Town: A Case study of site 5, November 29, 2015, Masiphumelele, shack fire. Your participation and feedback will be appreciated. Questionnaires are for research purposes only, and all information will be strictly confidential.

Complete the questionnaire by writing the answers in the space provided or simply put an X in the appropriate space. Section 1 must be completed by all participants. Section 2 to 4 to be completed by the community member-only and Section 5 to be completed by the Emergency response official only.

Section 1: Demographics

1 Gender:

1	Male	
2	Female	

2 Age in years:

1	21 - 25	
2	26 - 35	
3	36 - 45	
4	46 - 55	
5	56 - 60	
6	Over 60	

3 Highest level of education

1	No school	
2	Grade 1 - 4 (Lower Primary)	
3	Grade 5 – 7 (Upper Primary)	
4	Grade 8 – 10 (Junior Secondary)	

5	Grade 11 – 12 (Senior Secondary)	
6	University, College, Technicon (Higher Education)	

Section 2: Community member

4 How many years have you been living in Site 5, Masiphumelele?

1	Less than a year	
2	1 – 2 years	
3	3 – 4 years	
4	5+ years	

5 What is the type of ownership of the dwelling you live in?

1	Own house/Structure	
2	Tenant	
3	Other (Specify)	

6 What type of material does your dwelling consist of?

1	Bricks	
2	Wood & Iron	
3	Other (Specify)	

7 What is your primary source of heating?

1	Electricity	
2	Paraffin	
3	Gas (LPG)	
4	Wood	
Other (Specify)		

Section 3: Response to Site 5 - Community Member

8 Have you or witnessed someone negatively affected by the fire on November 29, 2015 incident?

1	Yes	
2	No	

9 What distance did the nearest station respond to this incident?

1	Less than a km	
2	1 - 2 km	
3	3 – 5 km	
4	5+ km	
5	I don't know	

10 What were agencies attending to the incident?

1	Police	
2	Department of Human Settlements	
3	Fire Department	
4	Ambulance service	
5	Disaster Management	
6	Other: (Specify)	
7	I don't know	

11 According to your knowledge, how was emergency services notified of this incident?

1	Telephone	
2	Sending someone to the fire station	
3	Security Camera	
4	I don't know	

5	Other: (Specify)	

12 If with a phone, what phone number would have been called?

1	10111	
2	10177	
3	107	
4	021 590 1900	
5	021 782 0333	
6	021 480 7700	
7	112	
8	Other: Specify	
9	I don’t know	

13 Emergency services had no problem getting access to the burning dwellings.

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	
6	I don’t know	

14 Fire hydrants/ access to water were easily accessible by emergency services

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	
6	I don’t know	

15 There was assistance for victims available from disaster management or NGO's during and after the fire

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	
6	I don't know	

Section 4: Preparedness - Community Member

16 Do you have an informal settlement fire committee in your area?

1	Yes	
2	No	
3	I don't know	

17 How are you receiving fire information in your area?

1	TV	
2	Radio	
3	Fire department	
4	Community meetings	
5	Word of mouth	
6	Other (Specify)	
7	None	

8	No Clue	
9	I don't know	

In case of emergency, do you:

18 Know where exit points are located?

1	Yes	
2	No	
3	I don't know	

19 Know where your nearest assembly point is?

1	Yes	
2	No	

20 Do you own a fire extinguisher?

1	Yes	
2	No	

21 Do you own a First Aid kit?

1	Yes	
2	No	

22 In the event of a fire outbreak, do you Know where the fire assembly point is?

1	Yes	
2	No	

23 Have you taken part in an fire emergency drill this past 12 months?

1	Yes	
2	No	

24 Who issues your community’s early warning information?

1	Fire Department	
2	Community leader	
3	NO one	
4	Other (Specify)	

Appendix 2: Questionnaire administered to key informant interviews

ASSESSING EMERGENCY RESPONSE MANAGEMENT TO INFORMAL SETTLEMENT FIRES IN CAPE TOWN: A CASE STUDY OF SITE 5, NOVEMBER 29, 2015 MASIPHUMELELE, SHACK FIRE

Key Informant Interviews Respondents

I am carrying out a study on Emergency Response Management to informal settlement fires in Cape Town: A Case study of site 5, November 29, 2015, Masiphumelele, shack fire. Your participation and feedback will be appreciated. Questionnaires are for research purposes only, and all information will be strictly confidential.

Complete the questionnaire by writing the answers in the space provided or simply put an X in the appropriate space. Section 1 must be completed by all participants. Section 2 to 4 to be completed by the community member-only and Section 5 to be completed by the Emergency response official only.

Section 1: Demographics

1 Gender:

1	Male	
2	Female	

2 Age in years:

1	21 – 25	
2	26 – 35	
3	36 – 45	
4	46 – 55	
5	56 - 60	
6	Over 60	

Section 5: Organizational Section – Emergency Response Official

3 Which of the following agency do you work for/belong to?

1	Community forum	
2	Fire & Rescue	
3	SAPS	
4	Traffic	

5	Metro	
6	Disaster Management	
7	Other (Specify)	
8	None of the above	

4 How long have you worked/volunteered for the service/agency you belong to?

1	1 – 6 months	
2	6 -11 months	
3	1 – 2 yrs.	
4	2 – 5 yrs.	
5	5+ yrs.	

5 How many times have you responded to informal settlement fires?

1	0	
2	1 – 5	
3	6 – 10	
4	10+	

6 Were you part of the response team to Masiphumelele fire on 29 November 2015?

1	Yes	
2	No	

7 If yes, what was your role?

1	Fire Fighting	
2	Medical	
3	Scene Control	

4	Other (Specify)	

8 How many people responded to your organization?

9 In your opinion, which of the activities were well managed?

1	Incident Command	
2	Fire fighting	
3	Medical Assistance	
4	Scene Control	
5	Others (Specify)	
6	I don’t know	

10 In your opinion, which activities were managed the worst?

1	Incident Command	
2	Fire fighting	
3	Medical Assistance	
4	Scene Control	
5	Others (Specify)	
6	I don’t know	

11 In your opinion, were there enough resources to deal with the incident?

1	Yes	
2	No	
3	I don't know	

12 Fire hydrants/ access to water were easily accessible by emergency services

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	

13 All calls for formal/informal settlement fires are dealt with within a reasonable time?

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	

14 Our department has enough resources to deal with any informal settlement fire

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	

15 Our department has mutual agreements with other services/agencies

1	Strongly Agree	
2	Agree	

3	Neutral	
4	Disagree	
5	Strongly disagree	

16 Everyone responding to the fire usually knows who is coordinating the activities.

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	

17 I am fully aware of the incident command system.

1	Strongly Agree	
2	Agree	
3	Neutral	
4	Disagree	
5	Strongly disagree	

Appendix 3: Graphical presentations of results from the questionnaires administered to the Masiphumelele community.

Figure 4.6.1: Which of the following agencies do you work for or form part of?

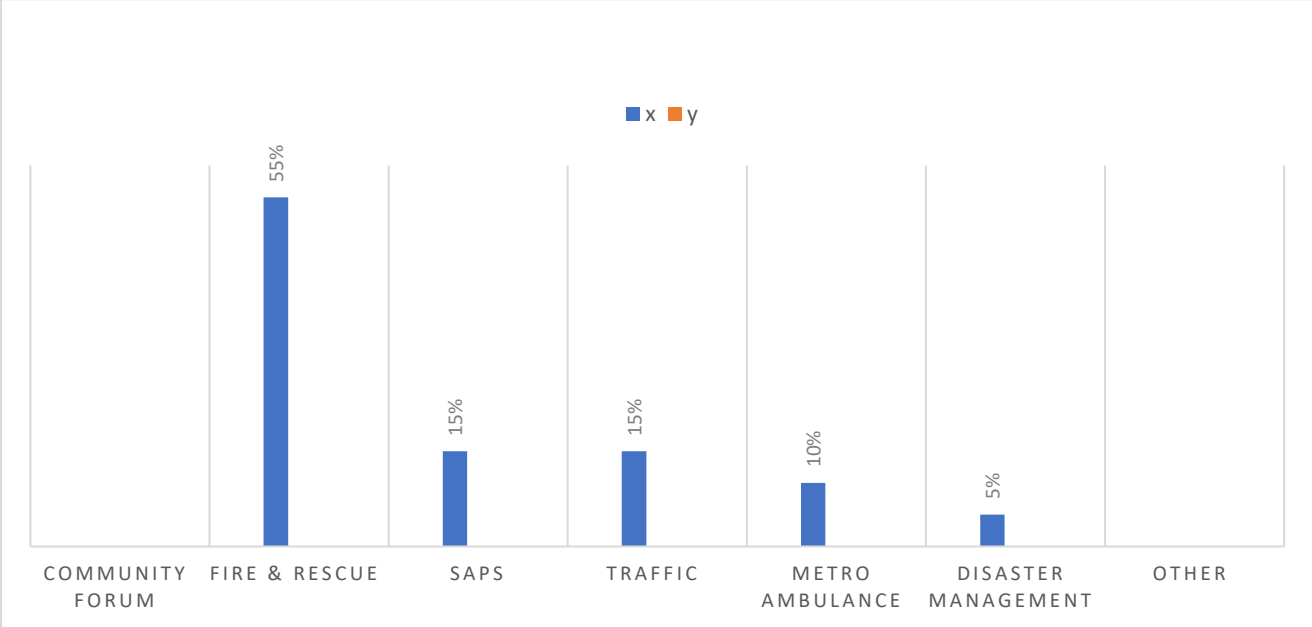


Figure 4.6.2: How long have you worked/volunteered for the service/agency you belong to?

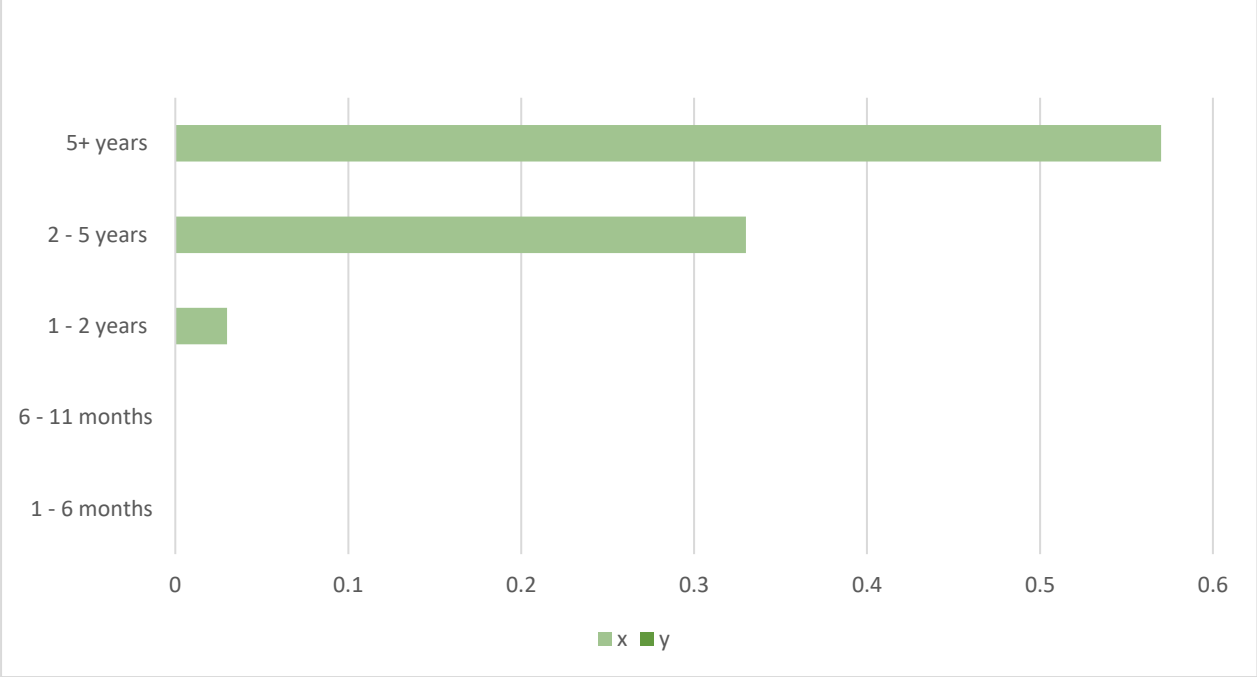


Figure 4.6.3: How many times have you responded to informal settlement fires?

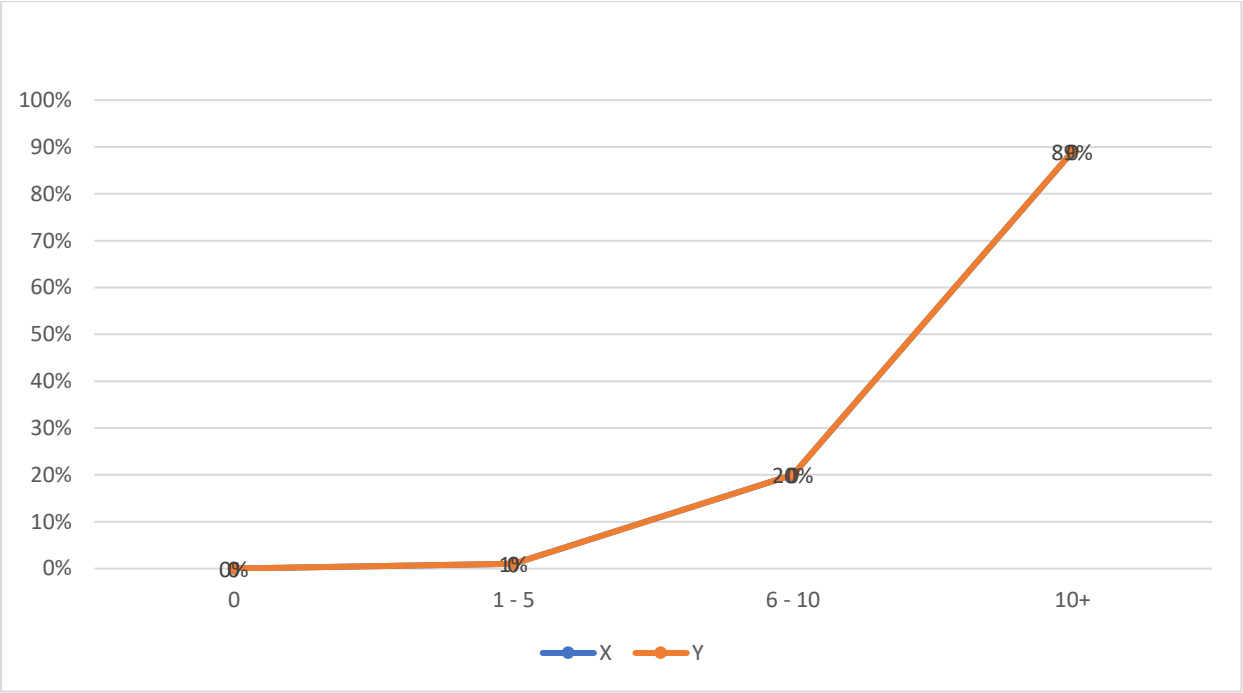


Figure 4.6.9: What was your role during the emergency?

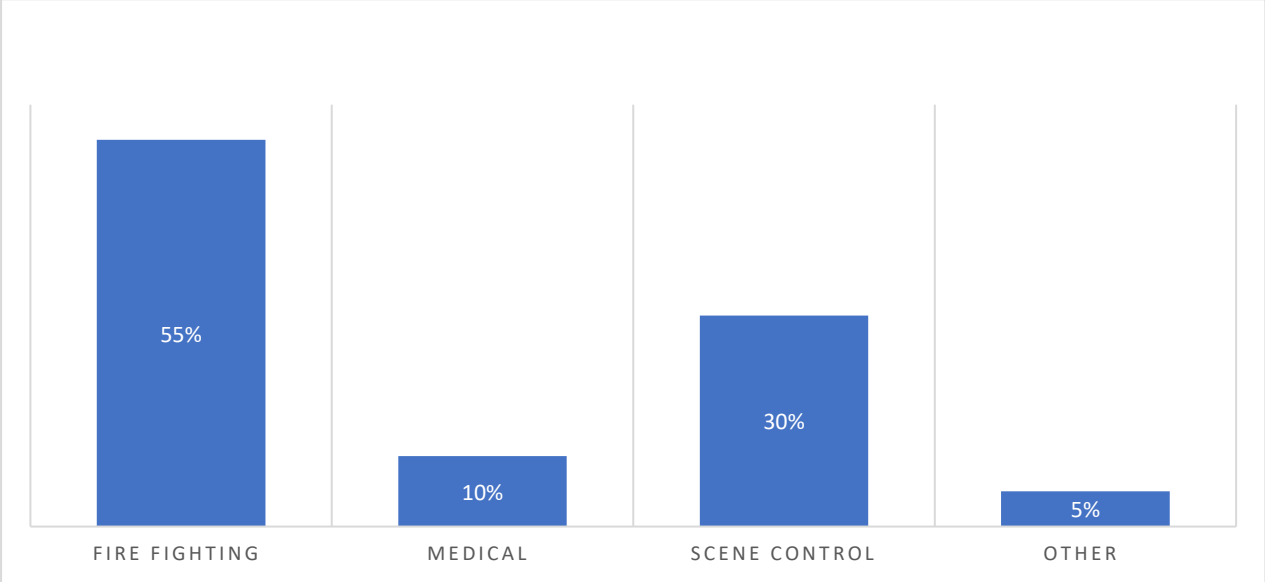


Figure 4.6.10: In your opinion, which of the activities was well managed?

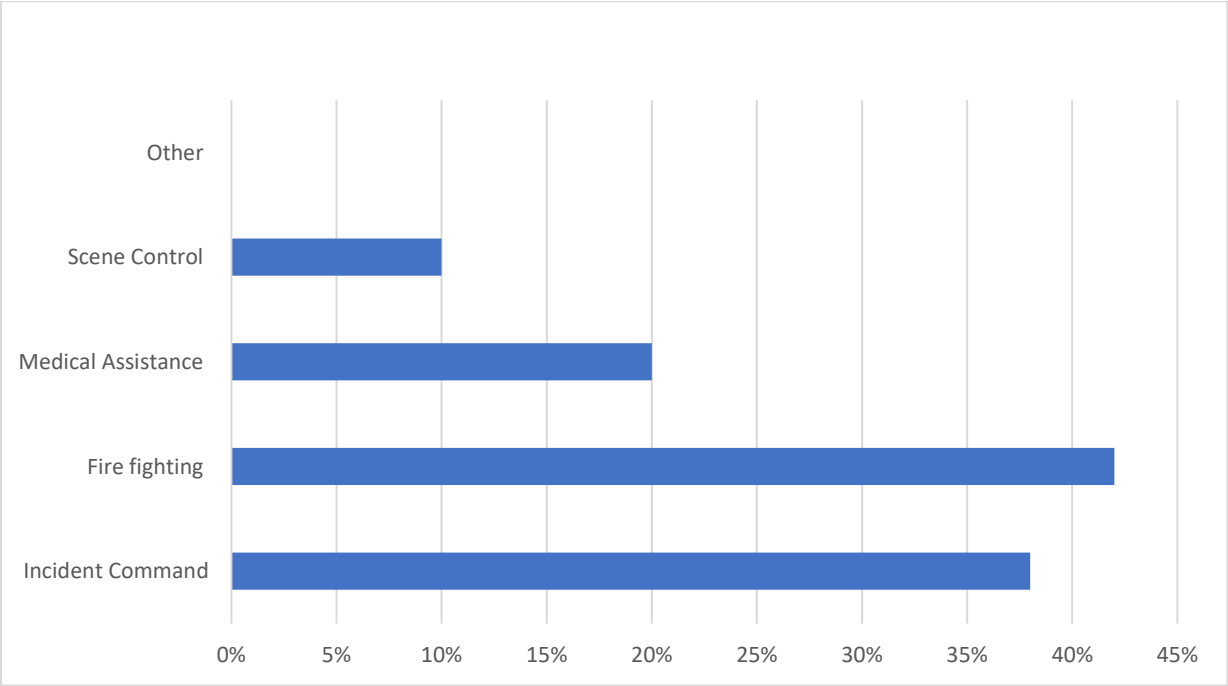


Figure 4.6.11: In your opinion, which activities were managed the worst?

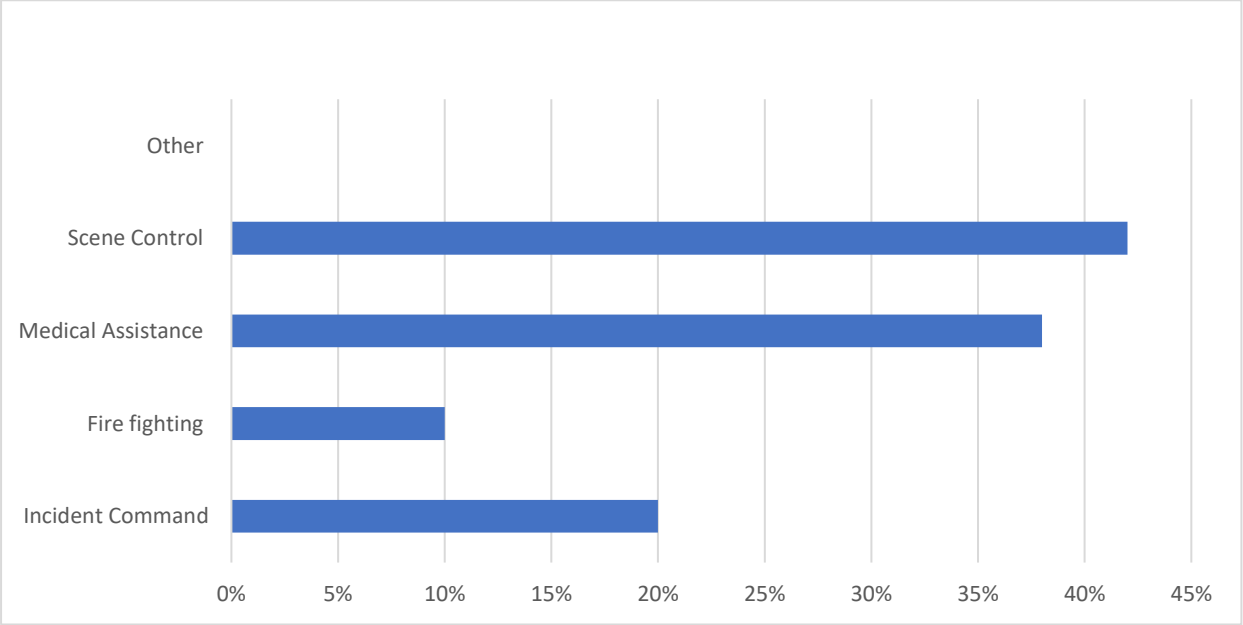


Figure 4.6.12: In your opinion, were there enough resources to deal with the incident?

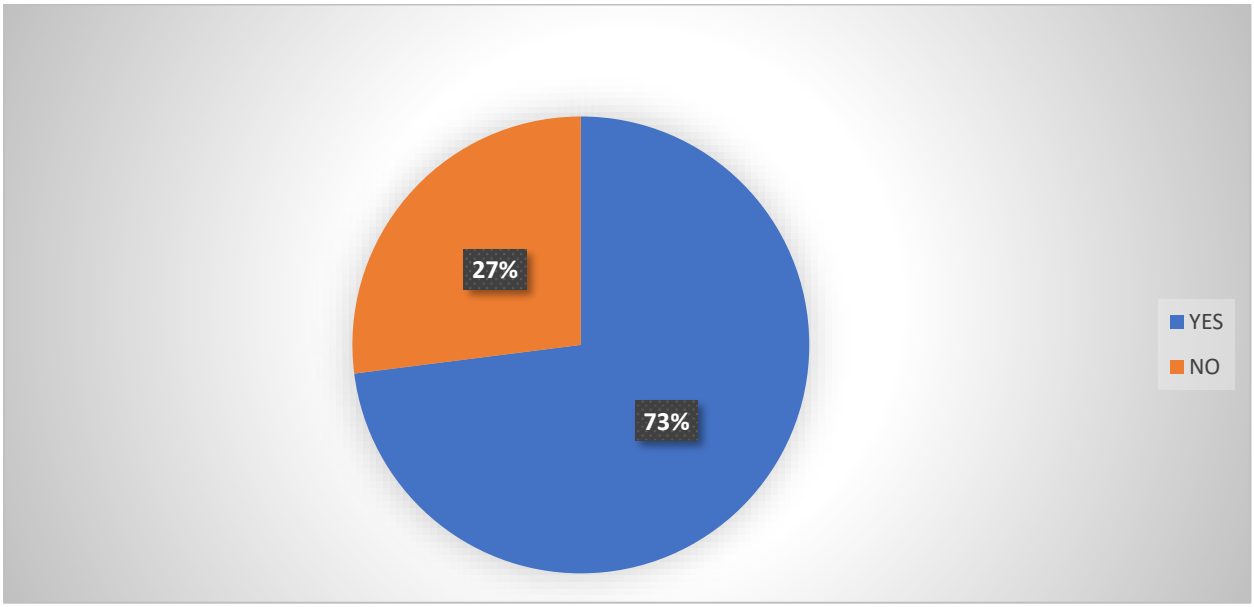


Figure 4.6.13: Fire hydrants and water were easily accessible by emergency services

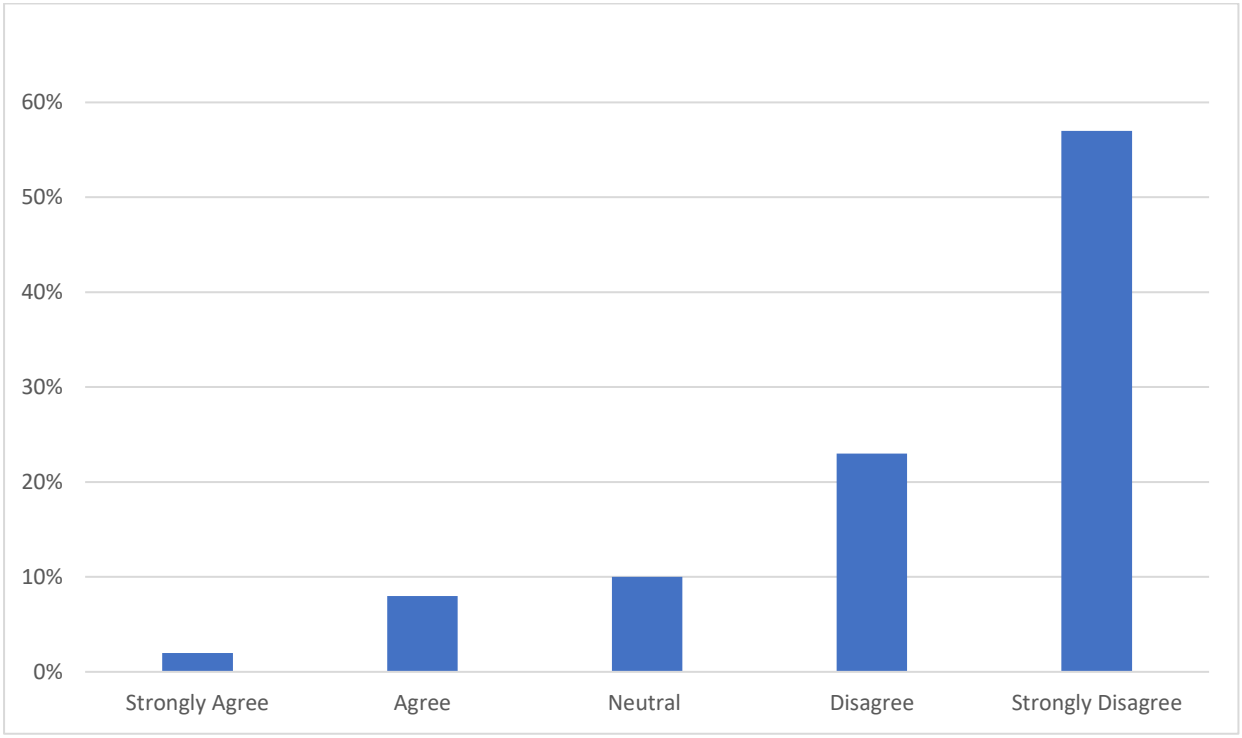


Figure 4.6.14: Are all calls for formal/informal settlement fires dealt within a reasonable time span?

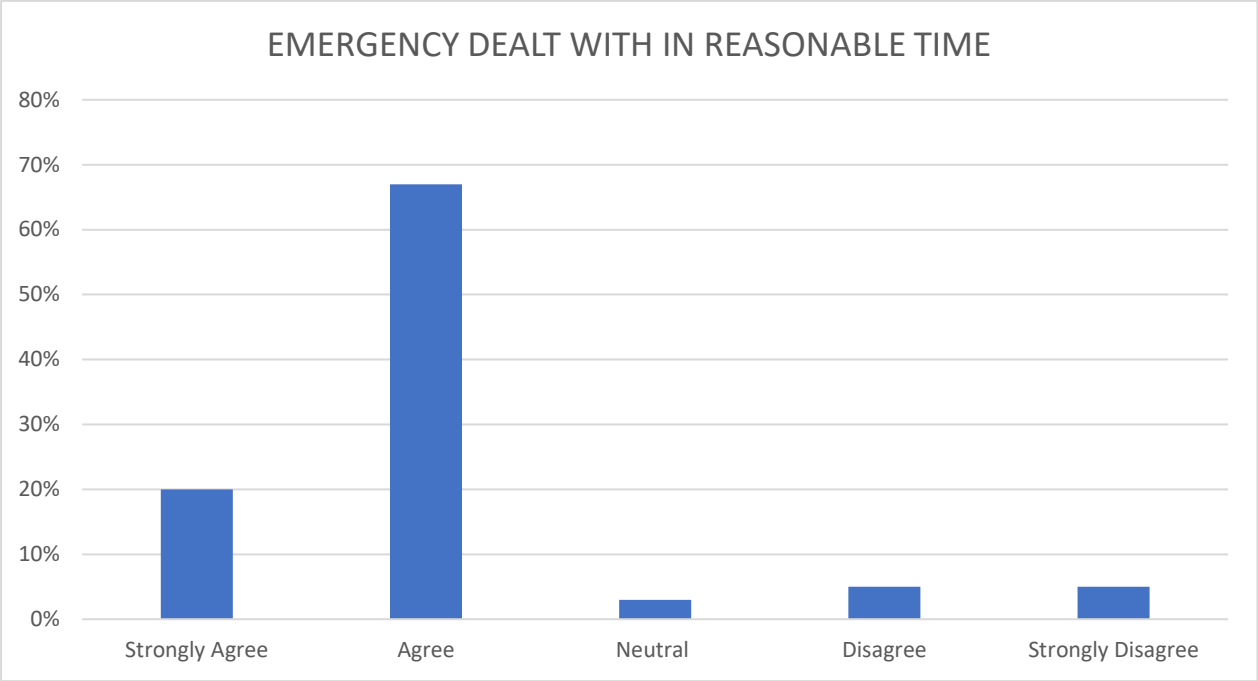


Figure 4.6.15: Our department has enough resources to deal with any informal settlement fire

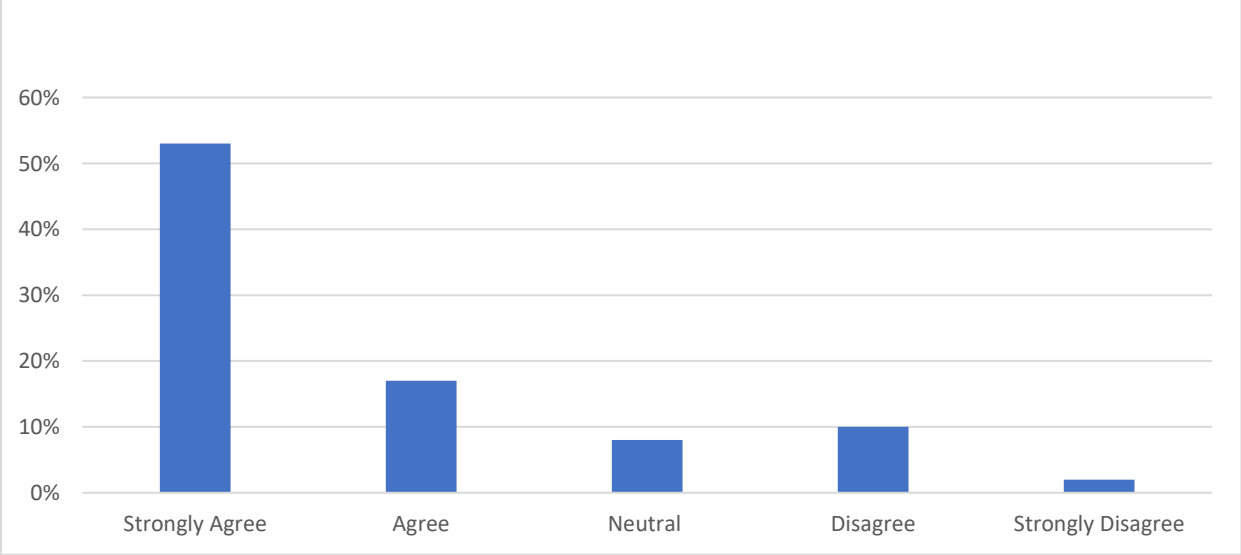


Figure 4.6.16: Our department has mutual agreements with other services or agencies

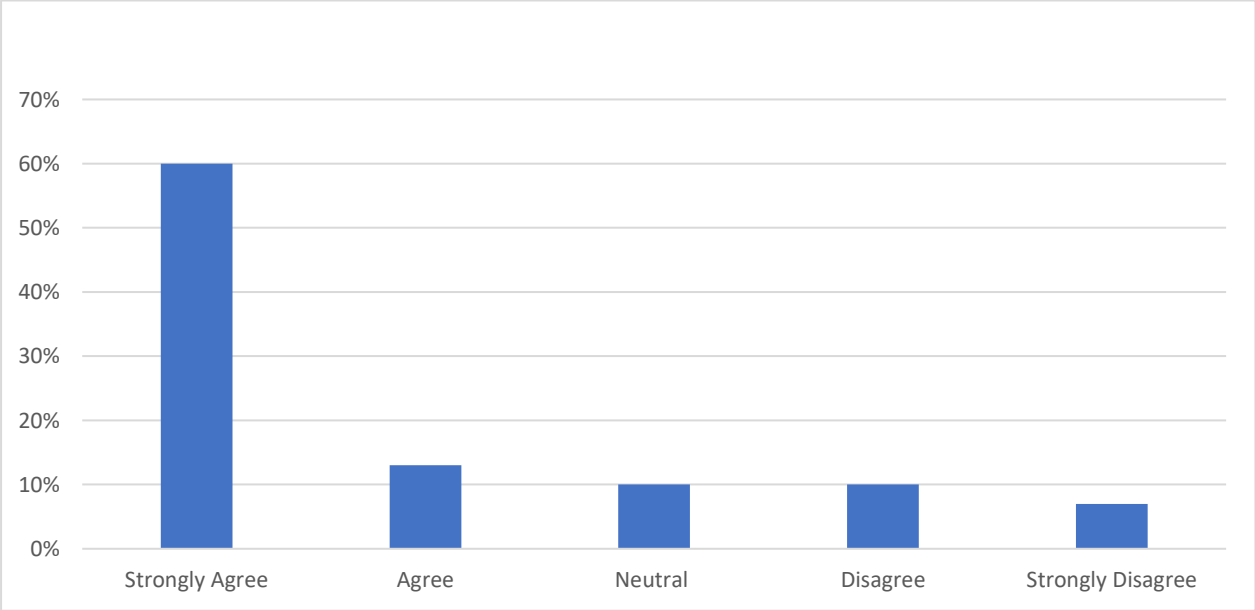


Figure 4.6.17: Everyone responding to the fire usually knows who is coordinating the activities

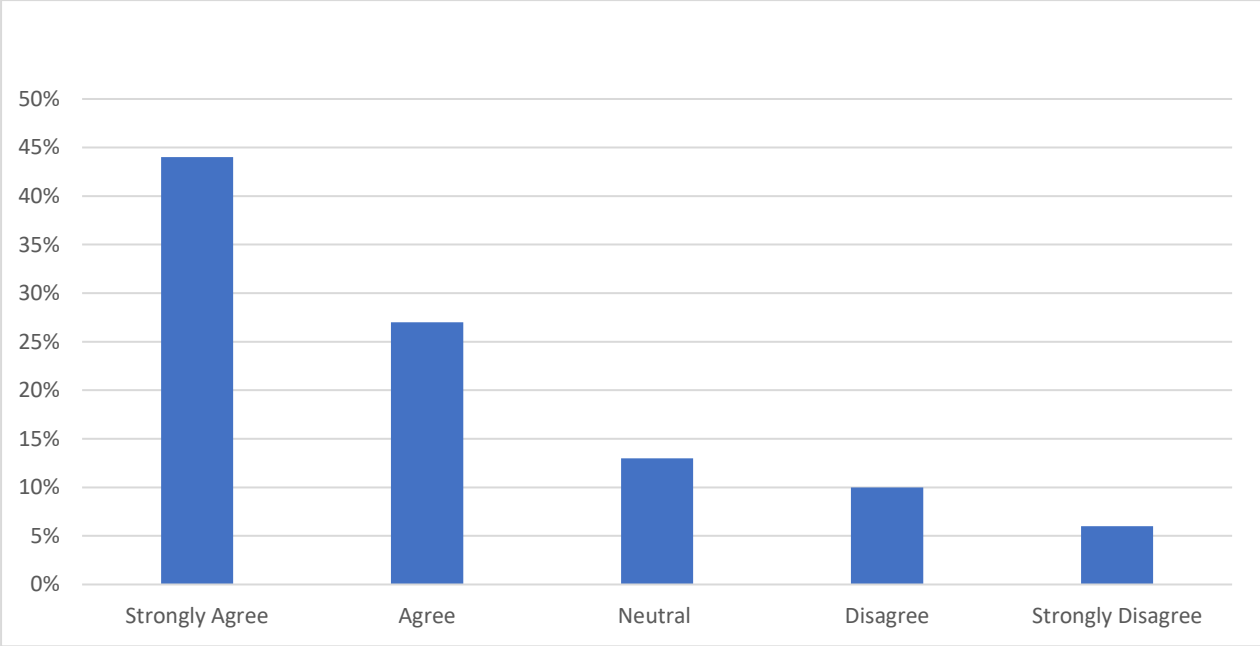
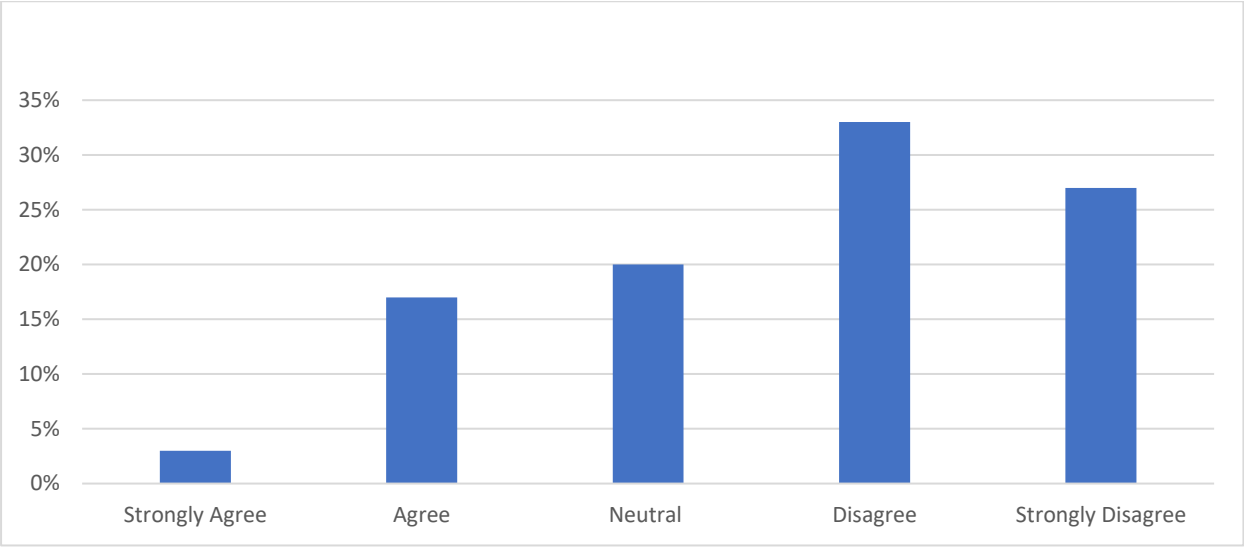


Figure 4.6.18: I am fully aware of the incident command system



Appendix 4: Site 5, Masipumelele incident report 29 November 2015

s12H INCIDENT REPORT - F1511/3854

NUMBER : F1511/3854 CATEGORY : Residential
DATE : 29 NOV 2015 SUB-CAT : Formal
TIME OF CALL: 00:21 RESOURCES : Despatched at 00:23
METHOD : 11 Telephone direct

OTHER SERVICES INFORMED : 00:31 CALL VERIFIED BY: Monica.,00:39 Media Liaison: Layne.,00:41 Electricity Dept: Ref 1010576711 City.,00:44 S.A. Police Services: Ref: 3436107- Elston.,00:46 Disaster Management: Gavin.,00:47 TOC: Ref 576782.,01:18 Metro Police: ,01:46 On Call Staff: Dc Eksteen Informed - He Will Monitor.,01:51 TOC: ,01:56 TOC: As Per Waterworks (Calvin) Mr Harris (Responsible For Reservoirs) He Will Send Someone Immediatly.,02:03 Electricity Dept: Mr.Shepard - Informed Cv4.,02:03 S.A. Police Services: Prov.Joc.,02:03 Metro Police: ,02:16 TOC: For National Parks.,02:26 OTHER: Mr Dilgee.,02:53 On Call Staff: Imt - Contacted.,03:31 Ambulance Services: Metro Ambulance Ref: 0407 - Meagan.,04:00 S.A. Police Services: Police Infored.,05:49 Animal Welfare: Spca Informed Regarding The Injured Cat.,06:15 Ambulance Services: Cape Medical Response - Michelle.,08:16 S.A. Police Services: Ref No:3491907.,08:18 Disaster Management: Chevonne Informed.,13:40 TOC: Informed Re: Hydrant 1010577239.

TELEPHONE : 0836058835 CALLER : Bolelo
CALLER SAID : Structure Alight

ADDRESS : SITE 5 (MASIPHUMELELE) INFORMAL SETTLEMENT, D Section Masemola Road, KOMMETJIE, SOUTH PENINSULA, 117, DA/17,18 Riverside Roade, Sub-cat changed from Informal
OWNER : South Africa National Parks (Erf No.4198-Re), City Of Cape Town (Erf No.Ca945-25),
OCCUPIER : See Attached List.
DISTRICT : West

DIVISION RESPONDED : WD3

STATION/S RESPONDED :
Fish Hoek,Simonstown,Ottery,Hout Bay,Lakeside,Kraaifontein,Lansdowne,Milnerton,Mitchells Plain,Khayelitsha,Mfuleni,Brackenfell,Epping,Roeland Street,Constantia,Goodwood,Wynberg

FIRE CATEGORY : Category 1,No Charge

RESOURCES	OFFICER	CREW	DISTANCE & TIMES
049 E (FSH)	Iliffe S	Diamond C	8 Km 14:21 hrs Service trip
		Du Plessis A	00:23 Mob Inc 00:28 Mob Inc
		Griffiths JR	00:34 At Inc 14:44 MobHome
		Olckers JK	14:45 Redirec
035 E (SMT)	Muller CA	De Maar F	18 Km 10:43 hrs Service trip
		Fortune I	00:23 Mob Inc 00:27 Mob Inc
		Jonathan JR	00:39 At Inc 08:41 MobHome
		Murdoch S	08:55 Avail 14:24 Mob Inc
		Dawson I	14:36 At Inc 16:23 MobHome
		Gerstner RJ	16:37 Avail
		Rasper VD	
		Wernars K	
304 RV (OTY)	Okkers M	Foster G	76 Km 09:10 hrs Service trip

			00:23 Mob Inc 00:27 Mob Inc
			00:59 At Inc 08:56 MobHome
			09:34 Avail
420 WT (HBY)	Pollet J	Frieslaar AD	55 Km 08:20 hrs Service trip
			00:24 Mob Inc 00:32 Mob Inc
			01:02 At Inc 07:53 MobHome
			08:45 Avail
001 E (LKE)	Jacobs RR	Bond J	51 Km 08:44 hrs Service trip
		Bougaard G	00:35 Mob Inc 00:38 Mob Inc
		Daniels G	00:57 At Inc 08:56 MobHome
		Evans SD	09:19 Avail
419 WT (KFN)	Williams LS	Van Zyl F	128 Km 07:11 hrs Service trip
			00:36 Mob Inc 00:42 Mob Inc
			01:46 At Inc 06:25 MobHome
			07:47 Avail
411 WT (LDN)	Nombakuse JG	Abrahams DA	104 Km 07:08 hrs Service trip
			00:38 Mob Inc 00:47 Mob Inc
			02:14 At Inc 07:01 MobHome
			07:47 Avail
403 WT (MIL)	Sibanda P	Baza DD	94 Km 07:48 hrs Service trip
			00:42 Mob Inc 00:45 Mob Inc
			01:47 At Inc 08:04 MobHome
			08:30 Redirec
114 BF (OTY)	Milton J	Cornelius G	65 Km 09:46 hrs Service trip
			01:06 Mob Inc 01:10 Mob Inc
			01:44 At Inc 07:38 MobHome
			08:19 Avail 13:58 Mob Inc
			14:00 Mob Inc 14:50 At Inc
			15:48 MobHome 16:32 Redirec
014 E (BKN)	Erickson JS	Khan MS	8 Km 00:24 hrs No service
		Moody DP	01:26 Mob Inc 01:27 Mob Inc
		Titus K	01:50 Redirec
		Vermaak G	
052 E (MPN)	Hess MC	De Beer D J	105 Km 06:58 hrs Service trip
		Koti N	01:27 Mob Inc 01:31 Mob Inc
		Olivier D	02:05 At Inc 08:24 MobHome
		Walters I	08:25 Redirec
022 E (HBY)	Laingno E	Gertse W	31 Km 06:36 hrs Service trip
		Rooza CM	01:32 Mob Inc 02:04 At Inc
		Strauss J	08:05 MobHome 08:08 Redirec
		Strydom G	
011 E (OTY)	Damons LW	Armien MT	50 Km 11:54 hrs Service trip
		Ruiters JDR	01:49 Mob Inc 02:16 At Inc
		Sansom RJ	06:58 MobHome 07:39 Avail
		Solomons R	09:15 Mob Inc 09:36 Mb LKE
		De Lange C	09:49 Avail 10:27 Mob Inc
		Jonkers MB	10:30 Mob Inc 10:50 At Inc
		Monki BK	15:15 MobHome 15:58 Avail
		Van Schalkwyk L	
		De Lange C	
		Jonkers MB	
		Monki BK	
		Van Schalkwyk L	
016 E (KYA)	Zenzile L	Booysen RD	112 Km 06:23 hrs Service trip
		Kroon A	02:30 Mob Inc 02:34 Mob Inc
		Makasi LZ	02:48 Mob Inc 03:01 At Inc
		Selana VG	07:56 MobHome 08:54 Avail
409 WT (LKE)	Pellew WM	Davis Ferguson	16 Km 07:04 hrs Service trip
			02:33 Mob Inc 03:12 At Inc
			09:00 MobHome 09:30 Avail
			15:23 Mob Inc 15:23 Mob Inc
			15:30 Redirec
003 E (MFU)	Smidt RW	Baba S	95 Km 06:56 hrs Service trip
		Lottering JM	02:33 Mob Inc 02:44 Mob Inc

		Mzizana MV	03:47 At Inc 08:32 MobHome
		Nggentsu N	09:30 Avail
044 E (BFL)	Armstrong MC	Adams RD	129 Km 07:02 hrs Service trip
		Brown A	02:33 Mob Inc 02:38 Mob Inc
		Crowster N A	03:41 At Inc 08:25 MobHome
		Young E	09:36 Avail
O09 CAR (RDS)	Abrahams SC		0 Km 09:28 hrs Service trip
			02:35 Mob Inc 02:35 Mob Inc
			03:02 At Inc 12:03 MobHome
			12:03 Avail
O04 CAR (RDS)	Alers BA		0 Km 09:04 hrs Service trip
			02:59 Mob Inc 03:02 At Inc
			12:03 MobHome 12:03 Avail
919 SB (BVL)	Murtagh BG		215 Km 05:42 hrs Service trip
			02:59 Mob Inc 03:12 At Inc
			08:41 MobHome 08:41 Avail
418 WT (EPG)	Rix WW	Whiteman A	80 Km 04:43 hrs Service trip
			03:03 Mob Inc 04:12 At Inc
			06:58 MobHome 07:47 Avail
405 WT (RDS)	Isaacs D T	Walters KP	93 Km 09:17 hrs Service trip
			03:05 Mob Inc 03:05 Mob Inc
			04:03 At Inc 07:18 MobHome
			08:06 Avail 09:28 Mob Inc
			09:40 MobHome 09:41 Redirec
			11:14 Mob Inc 11:17 Mob Inc
			12:06 At Inc 15:13 MobHome
			15:18 Redirec
936 SC (RDS)	Slamdien MT		822 Km 03:06 hrs Service trip
			03:05 Mob Inc 03:06 At Inc
			06:11 MobHome 06:12 Avail
705 CV (LKE)	Pietersen MB		18 Km 05:04 hrs Service trip
			03:11 Mob Inc 03:24 Avail
			03:29 Mob Inc 03:30 Mob Inc
			04:01 At Inc 08:06 MobHome
			08:20 Avail
O14 CAR (OTY)	Eksteen PDM		0 Km 05:11 hrs Service trip
			03:12 Mob Inc 03:12 At Inc
			07:46 MobHome 08:23 Avail
408 WT (GTU)	Andreka MS	Cebu NN	44 Km 00:18 hrs No service
			03:13 Mob Inc 03:16 Mob Inc
			03:32 Redirec
O29 CAR (OTY)	Hendricks GW		0 Km 05:14 hrs Service trip
			03:31 Mob Inc 03:31 Mob Inc
			04:25 At Inc 08:07 MobHome
			08:46 Avail
930 SC (EPG)	De Kock NA		11903 Km 01:57 hrs Service trip
			04:51 Mob Inc 04:51 Mob Inc
			05:52 At Inc 06:14 MobHome
			06:49 Avail
HEL 05 (CON)			0 Km 01:08 hrs Service trip
			07:48 Mob Inc 08:04 At Inc
			08:56 MobHome 08:56 Avail
932 SC (CTA)	Pietersen MB		38 Km 06:15 hrs Service trip
			09:16 Mob Inc 15:32 Avail
931 SC (FSH)	Dreyer LW		16 Km 06:13 hrs Service trip
			09:18 Mob Inc 09:19 Mob Inc
			09:31 At Inc 15:32 Avail
914 SB (RDS)	Rasper VD		29 Km 00:49 hrs Service trip
			09:19 Mob Inc 09:19 Mob Inc
			09:32 At Inc 09:49 MobHome
			10:09 Redirec
123 WT (FSH)	Crown C		12 Km 05:36 hrs Service trip
			09:21 Mob Inc 09:32 At Inc
			14:56 MobHome 14:58 Redirec

009 E (CTA)	Barendse MS	Daniels S	41 Km	05:40 hrs Service trip
		Parenzee I	09:21 Mob Inc	09:58 At Inc
		Van Der Horst V	14:40 MobHome	15:02 Redirec
		Christopher G		
410 WT (GWD)	Fourie J	Moolman MV	89 Km	03:50 hrs Service trip
			13:58 Mob Inc	14:00 Mob Inc
			15:16 At Inc	16:20 MobHome
			17:49 Redirec	
012 E (WBG)	Daniels CP	Alexander R	54 Km	02:43 hrs Service trip
		Coetzee RM	14:15 Mob Inc	14:25 Mob Inc
		Southgate B	15:00 At Inc	15:29 Stop
			16:18 MobHome	16:59 Avail
101 BF (EPG)	Abrahams LP		0 Km	00:00 hrs No service
			14:34 Mob Inc	14:34 Avail

< F1511/3854 end of page 1 >

COMMENTS : Resource 049 E redirected to N15/8372,035 E redirected from N15/8369 (closed),,,,,,Resource 403 WT redirected to N15/8347,Resource 114 BF redirected to N15/8380,014 E redirected from N15/8328 (closed),Resource 014 E redirected to F1511/3868,Resource 052 E redirected to N15/8344,Resource 022 E redirected to N15/8342,011 E redirected from F1511/3842 (released),,409 WT redirected from F1511/3842 (released),409 WT redirected from N15/8374 (closed),Resource 409 WT redirected to F1511/3938,,,,,,418 WT redirected from F1511/3842 (released),405 WT redirected from F1511/3842 (released),Resource 405 WT redirected to N15/8355,Resource 405 WT redirected to F1511/3938,,,,Resource 408 WT redirected to F1511/3873,,,,,,Resource 914 SB redirected to N15/8359,Resource 123 WT redirected to F1511/3937,Resource 009 E redirected to F1511/3939,Incident closed when resource 410 WT redirected to F1511/3966

NO. SECTORS IMPLEMENTED : 04

ZONES IMPLEMENTED : Danger

HOLDING AREA/S : Nil

INCIDENT MANAGEMENT (Y/N) : N

WEATHER : Fine WIND : Strong TEMPERATURE : 15 - 20 Deg

DESCRIPTION OF PREMISES :
Wood & Iron Structures (947) And Four Formal Structures On Vacant And Enclosed Grounds

FPA OCCUPANCY : Residential - Formal
FPA CLASSIFICATION : Fire - manually extinguished

NESD Situation Report

WHAT WAS BURNING : Beds, Bedding And Personal Effects.

DESCRIPTION OF INCIDENT : Major Structural Fire,Average Vegetation Fire

ACTION PRIOR TO ARRIVAL OF BRIGADE : Nil

ACTION OF BRIGADE :
Division A: Extinguished With 4 X Jets From Echo 49 A (1000000 Litres),Division B: Extinguished With 4 X Jets From Echo 01 A (964860 Litres),Division C: Extinguished With 2 X Jets From Whiskey 03 C (54300 Litres),Division D: Extinguished With 3 X Fog Jets From Whiskey 03 C; Whiskey 05 C And Bravo 14 (21600 Litres).

EQUIPMENT USED : 34 X 65mm Hose; 26 X 45mm Hose; 3 X Hosereels

FIRE EQUIPMENT INSTALLED : No

FPA SUSPECTED CAUSE : Undetermined
CAUSE - FURTHER COMMENTS : Suspected Resident/S Being Inebriated, Leaving Cooking Fire (With Oil) Unattended
FORCED ENTRY : No

WATER Charged : 21600 litres
WATER No Charge : 2019160 litres
SOURCE : MP WT SH PUMPING TIME : 07:50

ESTIMATED LOSS - BUILDING/VEHICLE : R5000000 CONTENTS : R10000000

FIRE DAMAGE : Entire Structures (947) And Contents And Four Formal Structures And Contents Severe By Fire, Heat, Smoke And Water.

NO RESOURCES/WATER CRAFT/AIR CRAFT INVOLVED

DETAILS OF CASUALTIES

Civilian Unknown, Female, Fatal Y

Civilian Unknown, Male, Fatal Y

BRIGADE PERSONNEL INJURED : S/Ff R.Samson (Ottery),Ff F.De Maar (Simonstown)

REMARKS :
DIVISION DELTA:
NATIONAL PARKS ON SCENE (CLINTON DILGEE). 2 X WATER TENDERS AND 1 X UNIMOG AS WELL AS GROUND CREWS ATTENDED TO REEDS FIRE ON ERF NUMBERS:CA945-25 AND 4198-RE
1 X HELICOPTER USED FOR WATER BOMBING FROM 08H06 TILL 09H00 ON SUNDAY 29/11/2015.

ACCOUNT FOR : DIVISION DELTA:
SOUTH AFRICAN NATIONAL PARKS
16 STELLENTIA AVENUE
STELLENBOSCH
7600
ERF NO.4198-RE
ALL FIREFIGHTING BY BRIGADE DONE ON ABOVE ERF 4198- RE
3 X FOG JETS FROM WHISKEY 03 C; WHISKEY 05 C AND BRAVO 14
21600 LITRES OF WATER USED FROM WATER TENDER AND STREET HYDRANT. 60% EFFECTED AREA
CITY OF CAPE TOWN
P.O BOX 4557
CAPE TOWN
8000
ERF NO.CA945-25
40% EFFECTED AREA
(SEE REMARKS)

PREVIOUS INCIDENTS :
F1607/1093 on 22 JUL 16 at 09:45,F1607/0893 on 17 JUL 16 at 17:12,F1607/0528 on 10 JUL 16 at 13:20,F1607/0348 on 07 JUL 16 at 07:27,F1606/1250 on 24 JUN 16 at 22:27

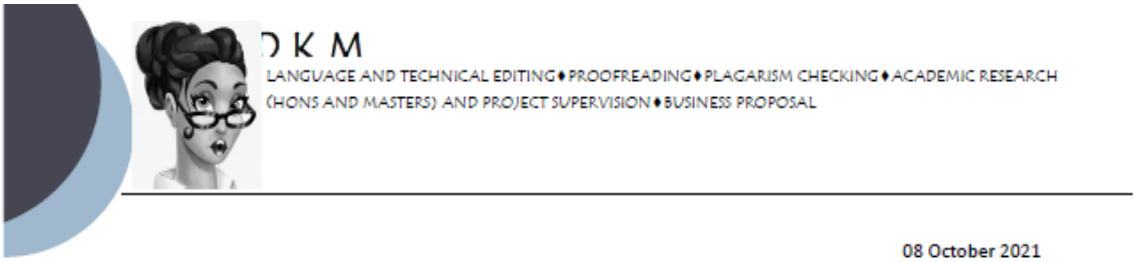
EST. PROPERTY VALUE.....R : 5000000

EST. CONTENTS VALUE.....R : 10000000

RESPONSIBLE OFFICIAL	PLATOON/STATION COMMANDER	DIVISIONAL COMMANDER
DATE	DATE	DATE

(Attach G.I.S map and sketch plan)

Appendix 5: Letter of Confirmation



08 October 2021

LETTER OF CONFIRMATION

I hereby confirm that I have done the language editing for the following dissertation:

Author: Mr J Pienaar
Title: Assessing emergency response mechanisms to informal settlements fires in Cape Town: A case study of Site 5, November 29, 2015 Masiphumelele shack fire

Document: Master of Disaster Management

I have edited Mr J Pienaar document and made appropriate changes and highlighted areas that the student needs to revisit. The document was edited using track changes and comments in Microsoft word.

I am not responsible for any additional information that is added to the document after I have edited it. The student is responsible for the final document submitted.

I trust you find the above in order.

Regards

Hazvinei Majonga
Registered Board: South African Translators Institute
Membership Number :10033691

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