Perceptions of Mineworkers of Environmental Risks in the Mining Sector: A Case Study of the Walvis Bay Salt Holdings (WBSH) Mine in Namibia

by

HILMA KAUNAPAWA SHAANIKA

Thesis submitted in fulfilment of the requirements for the degree

Master of Technology: Environmental Science & Occupational Studies

In the Faculty of Applied Sciences

At the Cape Peninsula University of Technology

Supervisor: Dr Vincent Zungu
Co-Supervisor: Ms Patience Mbola

District Six Campus

January 2022

DECLARATION

I, Shaanika, Hilma Kaunapawa, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed:  **Date: 20/01/2022**

ABSTRACT

Background: This research study was conducted to investigate the causes of environmental risk at a salt mining operation in Namibia, specifically from the perspective of the perceptions of general mineworkers of the types of risk to which their work exposed them and their environment. At present, although there is a prodigious amount of literature pertaining to the causes of environmental risk in mining, there is relatively little that is based on the perceptions of mineworkers themselves. In addition, the researcher elected to base the evaluation of the perceptions of general mineworkers on critical realism theory, as opposed to the positivist assumptions upon which assessments of environmental risk that are usually carried out in the mining sector are traditionally based. Critical realism theory permitted the researcher to evaluate the subjective perceptions of mineworkers in relation to a real world that exists independently of human perceptions and to discern how they were influenced by factors such as socioeconomic backgrounds, levels of educational attainment, and political affiliations (Von Kotze, 1999).

Methods: A mixed-methods approach was adopted to conduct the study and the researcher made use of both quantitative and qualitative research methods to collect data. The qualitative data was obtained from in-depth one-on-one face-to-face interviews, focus group discussions, direct observations of mineworkers in their working environment, and secondary sources, such as document analysis. The quantitative data was collected through the administration of a survey questionnaire. The sets of qualitative and quantitative data were systematically analysed through the use of computer-aided analytical software, namely, Atlas ti and SPSS respectively.

Findings: The findings that the analyses generated suggested significant differences between the perceptions of environmental risk and safety, and health on the mine of members of the management workers and general mineworkers. They also demonstrate measures to ensure the safety and health of mineworkers have been largely ineffective for some groups, particularly contractual workers, despite the drafting of legislation and regulations to ensure safety and improve working conditions at mines. The findings of the study should make a valuable contribution to the existing body of knowledge that research in the fields of environmental management, the management of environmental risk, and working conditions in mines in southern Africa generates.

Keywords: *Environmental risk, critical realism theory, perceptions of risk, risk, mineworkers, Walvis Bay Salt Holdings*

ACKNOWLEDGEMENTS

First and foremost, I would like to express my sincerest gratitude and appreciation to my Creator and Redeemer, for bestowing His blessings on me and for granting me the necessary courage, strength, good health, and fortitude to complete the study.

Secondly, I wish to express my deepest appreciation and to thank the following people who contributed to the success of my study:

- My supervisor, Dr Vincent Zungu, and co-supervisor, Ms Patience Mbola, for guiding me throughout this project, my deepest gratitude!
- My HOD, Dr Malaza, for his unwavering support and wise counsel throughout this research, my deepest appreciation to you, sir!
- Departmental and faculty academics and fellow postgraduate students, thank you for the guidance that you gave to me during the presentation and defence of my proposal.
- My entire family, for their support throughout my life.
- My mentor, Blessed Mhungu, for support, guidance, and believing in me.

The author assumes full responsibility for the opinions that are expressed in this thesis and the conclusions that were reached as a result of conducting the study and wishes to emphasise that they cannot necessarily be attributed to WBSH or CPUT.

DEDICATION

I dedicate this piece of work to all my friends and family. A special dedication goes to my parents, Mr and Mrs Shaanika, for all their unwavering support, encouragement, and prayers, which enabled me to remain strong for the duration of my studies, and to my siblings, Michael, Hilka, Andreas, and Absalom for their moral support. It was not an easy road.

Thank you!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND KEY TERMS

AMWU	-	African Mine Workers Union
CoW	-	City of Windhoek
EAP	-	Environmental assessment policy
ECC	-	Environmental clearance certificate
EMP	-	Environmental management plan
EMS	-	Environmental management systems
ER	-	Environmental risk
EU	-	European Union
GMW	-	General mineworker
MET	-	Ministry of Environment and Tourism
MUN	-	Mineworkers Union of Namibia
MOHSS	-	Ministry of Health and Social Services
NUNW	-	National Union of Namibian Workers
TPMMW	-	Top management mineworker
UN	-	United Nations
UNWCED	-	United Nations World Commission on Environment & Development
WB	-	Walvis Bay
WBSH	-	Walvis Bay Salt Holdings

CHAPTER 1: INTRODUCTION AND CONTEXTUAL BACKGROUND

1.1 Introduction and background to the study

Employees of mining operations throughout the world have long been aware of the environmental risks that are inherent in mining and their effects and many have been vocal in their attempts to ensure that they are effectively reduced or minimised (Esi, 2012). This study took the form of an illustrative case study to investigate and evaluate the perceptions of environmental risks of mineworkers who were employed in the Walvis Bay Salt Holdings mine. It is specifically concerned with the environmental risks to which low-income workers are exposed in a mine in which matters pertaining to risk are the preserve of an occupational health and safety management system that has been adopted by the company that owns it. As a direct consequence, the low-income mineworkers who are employed by the company are continuously exposed to a range of risk incidents, such as acute or chronic water, air, and noise pollution, which could result in occupational hazards such as hearing loss, accidents, injuries, or other health risks. Over the past three decades, the emergence of the concept of sustainability has resulted in a shift from a technological conception of environmental risks to a broader analysis of risks (Esi, 2012).

From a historical perspective, owing to the manner in which mining operations were introduced in southern Africa, the perceptions of mineworkers of environmental risks have been largely neglected. It is the considered opinion of the researcher that socioeconomic and historical structural agencies are crucial to obtaining a sufficiently comprehensive understanding of these perceptions. In addition, she also contends that socioeconomic and structural agencies are not included or considered in the conventional understanding of environmental risk assessment, while Oelofse (2003) emphasises that it is imperative that environmental risks, including occupational health and safety risks, should be adequately understood. She maintains in her case study of an informal settlement in South Africa of 2003 that the causal mechanisms that shape the risk events and the contingent conditions that provide the contexts in which environmental risks occur should be clearly understood. From this standpoint, it is evident that the perceptions of employees of occupational health and safety, particularly in the mining sector, do not develop in a vacuum, but are largely influenced by their socioeconomic backgrounds or circumstances. It is within this context that the study was conducted to determine the range of occupational risks that are associated with salt mining activities from the perceptions of the participants. Employees who are most exposed to risks are those who are exposed to hazardous substances in their daily work activities and other work-related

risks, such as accidents from falling from heights and the health problems that result from air pollution.

In addition, Von Kotze (1999) points out that exposure to environmental risk places mineworkers at the risk of contracting diseases from hazardous waste and also contributes to the development of high levels of stress, which not only have adverse physiological consequences, but can result in increased absenteeism and even mental and emotional disorders. Although many mining companies in southern Africa have occupational health and safety regulations to mitigate environmental risks, only a limited number of studies have been published that centred on how employees perceived the regulations. It was for this reason that the researcher elected to conduct the study in her home country, in an endeavour to understand how mineworkers who are employed at the Walvis Bay Salt Holdings mine perceived the environmental risks that are associated with mining activities.

To give the study a sound theoretical basis that is grounded in a realistic understanding of ontology, the researcher elected to base the theoretical framework on critical realism theory, in the manner that Oelofse (2003) applied it to her case study of an informal settlement in South Africa. Critical realism theory is used to attempt to shed light on the structures that underlie the risk events, together with the conditions that are experienced locally, by challenging the dominant technical and scientific discourse that usually determines the understanding of risk (Karasar, 2005). In the framework that Oelofse (2003) developed from critical realism theory, environmental risk is viewed as a phenomenon that is not independent of the contextual background against which it occurs. By means of this framework, Oelofse (2003) identifies the causal mechanisms that shape risk events, while contingent conditions provide the specific contexts in which environmental risks are manifested. The findings of an earlier study that Foot (1989) conducted emphasised that contingent conditions also refer to the temporal and local variations that influence how risk is experienced. It was also concluded that causal mechanisms are the external influences that shape how environmental risk events occur in a particular local context. Accordingly, it is possible to contend that “causal mechanisms are underlying structures that shape how risk events are played out in society and space” (Watts & Bohle, 1993, in Oelofse, 2003). Consequently, it is crucial to note that perceptions of environmental risk are influenced by a combination of contingent factors and causal mechanisms: conditions that induce risk, perceived effects of risk, and risk outcomes act concurrently to shape particular risk events in space and time. It is from this standpoint that the researcher endeavoured to understand how mineworkers perceived the environmental risks that were prevalent in their work environment.

It is also necessary to emphasise that from the outset, the researcher resolved to obtain an understanding of risk events from the viewpoint of the mineworkers, giving due consideration to their underlying socioeconomic and political structures, as contingent factors, that shape their perceptions of environmental risk. A further highly relevant consideration is that the findings of studies that have been conducted elsewhere suggest that mineworkers are, to an ever-increasing extent, invisible in assessments of risk that is associated with mining activities (Clark *et al.,* 1998).

Among the conclusions that were drawn from the findings of a study that Hadden (1991) conducted was that understanding the complex social, economic, and political factors that influence how risk is perceived is crucial to the successful communication and management of risk. Another significant conclusion was that risk events are understood differently by different stakeholders and that the perceptions of local mineworkers of the risks and benefits of mining tend to differ significantly from those of company representatives, policymakers, and the scientific community. These conclusions provided a relevant context for evaluating the perceptions of mineworkers of environmental risks, against the backdrop of the implementation of the occupational health and safety programme of the mining company.

1.2 Statement of research problem

Since 1964, the Walvis Bay Salt Holdings mine in the Republic of Namibia, as the country has been known since it gained independence from South Africa in 1990, has produced an estimated 50 million tons of high-quality solar sea salt. Although mining companies generally have policies to ensure occupational health and safety and mitigate the environmental risks to which mineworkers are exposed, it is evident from the relevant available literature that employees are, in many cases, frequently exposed to unacceptable levels of environmental risk (Clark *et al.,* 1998). As it has been explained, present discourse tends to hold that risk and vulnerability in urban and industrial settings should be understood in terms of the causal mechanisms that shape risk events and contingent conditions pertaining to the nature and extent of the influence of environmental factors in particular settings, a standpoint that has guided the conducting of this study. Their socioeconomic status invariably contributes to low-income mineworkers being exposed to a range of risk incidents, such as high levels of noise, which is inevitably accompanied by a high risk of hearing loss, and being adversely affected by conditions that are characterised by a lack of access to safety infrastructure, weak partnerships between local employees and the management, and also inaccessible environmental legislation and policy (Oelofse & Patel, 2000).

The manifestations of environmental risk that emerged from the findings of the case study of the Walvis Bay Salt Holdings mine ranged from waste management and other sources of hazards, such as pollution, electric shocks, falling from high buildings, and burns, from the steam that drives turbines and the smoke that results from production, which can result in severe skin ailments. Although the positive contributions of occupational health and safety programmes have been widely documented (Justus, 2009), a limited amount of research appears to have been conducted to determine how these programmes are perceived by their intended beneficiaries, particularly in the mining sector (MOHSS, 2006). It has been found that some workers have been temporarily or permanently disabled by work-related accidents in recent years. It was concluded from the findings of the study that Marsh and Oelofse (1998) conducted that poor or inadequate health and safety practices increased both the risk of illness and chronic risk incidents, which results in depleted workforces, which, in turn, entail significantly increased costs for business organisations.

As there is incontrovertible evidence that mineworkers are frequently exposed to several types of environmental risks owing to the nature of their work (MOHSS, 2006; Von Kotze, 1999), the researcher elected to conduct a qualitative inquiry, as a component of a mixed methods study, to obtain an understanding of risk in the mining sector as it is perceived by mineworkers themselves. In a great many cases, portrayals of perceptions of risk in the mining sector have been predominantly coloured by the perspectives of mining experts, economists, and mainstream scientists. According to Von Kotze (1999), their analyses tend to be myopic, in that they usually emanate from a positivist orientation and exclude empirical considerations, which would otherwise reveal the vulnerability of mineworkers and the extent to which they are exploited. Justus (2009) explains that mainstream studies often attribute the acute risk to which employees are exposed to their lack of concern about safety precautions at work and a lack of knowledge of safety procedures. By contrast, Von Kotze (1999) emphasises that the perceptions and opinions of mineworkers of the risks that are inherent in mining operations continue to be ignored as a direct consequence of their poor socioeconomic backgrounds and circumstances, which make them vulnerable to exploitation and deprive them of an effective voice to ensure that their rights are protected.

1.3 Aim and objectives of the study

As the overall aim of the study was to obtain comprehensive and definitive answers to the research questions, the objectives can be summarised as follows:

- To determine how mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine.

- To explain why mineworkers, perceive the environmental risk to which they are exposed as a consequence of working for the Walvis Bay Salt Holdings mining company as they do.
- To determine whether any intervention strategies are being implemented at present by either mineworkers or the management to reduce or prevent environmental risk in the mining company.

The research sample comprised both mineworkers and members of the management of the Walvis Bay Salt Holdings company, in order to achieve the ultimate objective of the research, namely, to contribute to the development of innovative new measures to mitigate and manage environmental risk.

1.4 Research questions

Owing to increased demands by mineworkers for healthier and safer working environments, it is vital to understand how critical realism theory could potentially be used by mining companies to develop sound environmental policies to reduce or prevent environmental risk. The carrying out of this investigation was guided by a single main research question: How do mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine? In order to answer this question, the researcher formulated the following two sub-questions:

1.4.1 Sub-question 1

Which intervention strategies are being implemented at present by the management of Walvis Bay Salt Holdings (Pty) Ltd to reduce or prevent environmental risk?

1.4.2 Sub-question 2

Why do mineworkers perceive the environmental risk to which they are exposed as a consequence of working for the Walvis Bay Salt Holdings (Pty) Ltd mining company as they do?

Table 1.1: *Summary of research questions and objectives of the study*

Research problem	Low-level mineworkers from socioeconomically disadvantaged backgrounds continue to be exposed to high levels of environmental risk in mining. As their interests are frequently ignored in decision-making procedures, it remains difficult for them to participate meaningfully in them.	
Main research question	How do mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine?	
Objectives	**Research sub-questions**	**Research methods**

To determine how mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine	Why do mineworkers perceive the environmental risk to which they are exposed as a consequence of working for the Walvis Bay Salt Holdings mining company as they do?	Literature review, document analysis, in-depth interviews, questionnaires
To determine whether any measures are being taken by either mineworkers or the management to reduce or prevent environmental risk in the mining company	Which intervention strategies are being implemented at present by the management of Walvis Bay Salt Holdings (Pty) Ltd to reduce or prevent environmental risk?	In-depth interviews, questionnaires, direct observation

1.5 Significance of the study

The principal significance of this research study lies in its potential to inform members of the general public, mineworkers, policy makers, and academics concerning the realities of environmental risk in the mining sector. At present, although risk assessments can be developed for workers and members of the general public, neither group is represented in the broader scheme of environmental risk discussions or policies that govern their well-being. It is intended that the findings of this study should provide new insights into the need to include mineworkers and other members of the general public in the making of decisions that affect their well-being, by a mining industry that has previously tended either to downplay or ignore their concerns pertaining to environmental risk.

Significant recommendations are made on the basis of the conclusions that have been drawn from the findings of this study for enabling previously disadvantaged mineworkers to be included in decision-making procedures and also concerning the measures that need to be taken to ensure that all mineworkers are adequately represented. As the recommendations are grounded in critical realism theory, they reflect a method of analysis that is widely accepted in contemporary sociological discourse as an effective means of evaluating social structure and phenomena without relying solely on empirical observation. Critical realism also provides a realistic basis for evaluating how mineworkers perceive environmental risk in mining and how their background and socioeconomic circumstances influence risk outcomes in their workplace. In addition, the findings of this study could be of great interest to policymakers, particularly those who are concerned specifically with formulating strategies to reduce environmental risk. As the management and measurement of environmental risk have received a considerable amount of scientific scrutiny and the existing pool of knowledge is expanding continuously, the findings also stand to make a meaningful contribution to the existing literature pertaining to environmental risk in the mining sector.

1.6 Limitation and delimitation of the study

As this study took the form of a case study of a single mining operation in Namibia and, owing to the subjective nature of the qualitative data, the findings and the conclusions that have been drawn from them cannot necessarily be generalised to other mining operations, even in Namibia. As a consequence of the limited period of time that was available to conduct the study and budgetary constraints, the researcher was not able to evaluate the management of environmental risk and the implementation of the occupational health and safety programme of the company in all departments of WBSH.

1.7 The study area

The study area, the land occupied by the mine of Walvis Bay Salt Holdings (Pty) Ltd, is situated in the Erongo region of Namibia. This salt mining company, through its subsidiaries, remains one of the largest producers of solar sea salt in sub-Saharan Africa. It generates an annual yield of well over 700 000 tons of high-quality salt, from an area covering 4500ha, which makes it the largest salt mining operation in the region. The sea salt that is produced by this mining company is exported to a number of neighbouring countries in southern Africa, while excess salt is also exported to markets in other regions of Africa and Europe. Walvis Bay Salt Holdings (Pty) Ltd also produces high-quality table salt for human consumption, in addition to producing salt for the chemical industry and other general purposes.

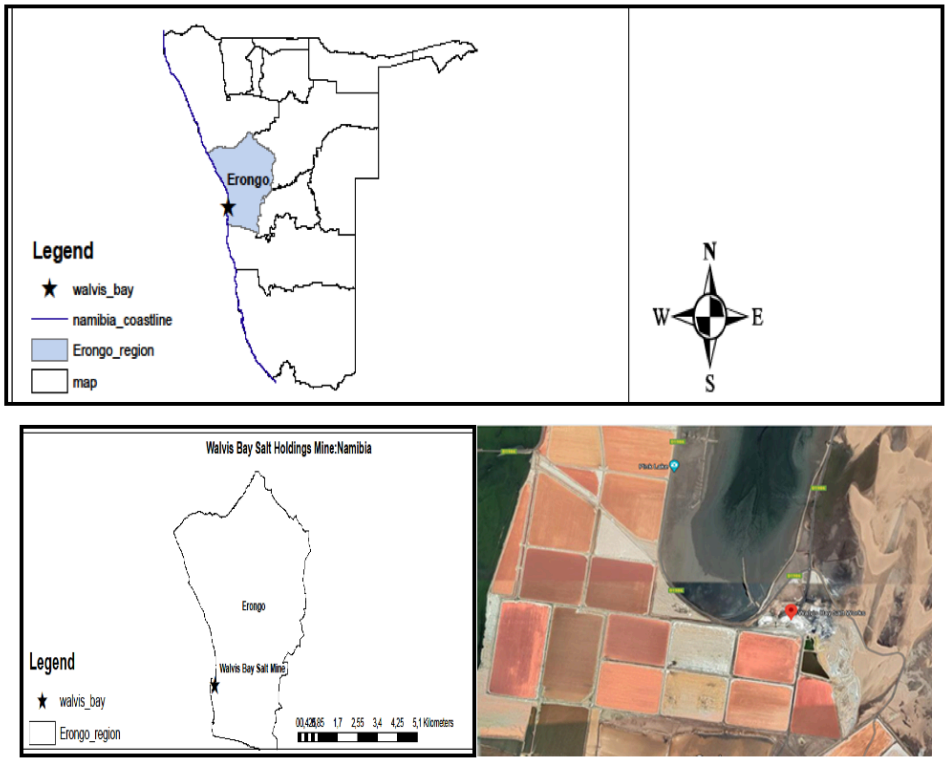


Figure 1.1: *The location of the Walvis Bay Salt Holdings mine (Author,2019)*

1.7.1 Products and operations

The production of salt at Walvis Bay is carried out by two subsidiary companies, namely, Walvis Bay Salt Holdings (Pty) Ltd and Salt & Chemicals (Pty) Ltd. Walvis Bay Salt Holdings (Pty) Ltd processes and markets the salt, while Salt & Chemicals (Pty) Ltd produces raw salt. The salt is produced from seawater and a dry mass of 99.44% pure sodium chloride (NaCl) is yielded from drying through evaporation. During the drying process, brine depths and densities are controlled to ensure that the maximum number of unwanted chemical impurities are precipitated before the solution enters the crystallisers (Fernandes, 2014). Stimulated by wind and sun, the brine salinity or degree of concentration of the salt water gradually increases until it reaches 25%, at which point it is pumped into crystallisation ponds, each with a surface area of in the region of 20ha. The salt then crystallises, to form a layer of crystals on the crystalliser pavements. In this process, seawater, which is the only raw material, initially contains a 3.5% concentration of salts, of which 2.9% is sodium chloride, is pumped from a natural lagoon at a rate of 240m3 per minute into a series of pre-evaporation ponds, and then through a series of concentration ponds (Fernandes,2014).

WBSH has also adopted a programme to monitor the depth and density of the crystallisation ponds. The monitoring is carried out by on-site laboratory technicians, whose role is to ensure that crystallisation occurs at constantly optimal levels. During the crystallisation of the salt, once the salt crystals have grown to the required level, they are removed by mechanical harvesters and transported to the wash plant for further processing. At the wash plant, the salt undergoes washing through the use of dilute brine as the washing medium, whereby magnesium and calcium sulphate that adheres to the salt are removed. The final salt solution is then dried in a centrifuge and stored on a stockpile for further draining (Engelbrecht, 2011).

In the final stages of the crystallisation process, the washed salt solution is kept safe at the storage harbour, where it awaits being transported to either local or international destinations. At the harbour, salt is loaded onto ships and trucks for shipment to destinations both abroad and inside of Africa in unbroken 24-hour cycles, seven days a week. Although some of the salt is shipped to South Africa to be used in the chlor-alkali industry, increasing amounts are now being exported to other African countries within the sub-Saharan region. The salt that is prepared for consumers is packed at a bagging facility, in accordance with specific requirements, such as the masses of individual bags, the sizes of granules, and printed identification on bags of the brands of individual customers (Engelbrecht, 2011).

1.8 Guide to chapters

In order to demonstrate that appropriate procedures have been followed to conduct this study, a detailed summary of the structure of the thesis is provided in this section. It includes a comprehensive alphabetical list of references to the sources that were consulted to write the thesis, which is followed by a list of appendices, in which all required documentation is provided. The individual chapters are structured as follows:

1.8.1 Chapter One: Introduction and background to the study

The first chapter introduces and provides relevant background to the research topic, before proceeding to a statement of the research problem and a discussion of the study area and the location at which the study was conducted. The aim and objectives of the study are elucidated, as are the main research question and the sub-questions that were formulated to guide the conducting of the study. The chapter concludes with discussions of the significance of the study and its limitations and delimitations.

1.8.2 Chapter Two: Literature review and theoretical framework

The second chapter is devoted to a comprehensive review of the relevant available literature pertaining to the research topic and the theoretical framework that was developed to provide the research with a credible theoretical basis. It is divided into two parts, of which the first takes the form of a detailed historical overview of mining in southern Africa, the development of the concept of environmental risk in mining, and the extent to which mineworkers have been able to cope with it. The second part explains the development of the theoretical framework of the study, which was informed by critical realism theory, the theoretical orientation that the researcher used to evaluate the perceptions of mineworkers and their experiences of environmental risk at the mine and to analyse the data that the study generated.

1.8.3 Chapter Three: Research design and methodology

Chapter Three is a detailed discussion of the research design and the methodology that was chosen to conduct the study. It also includes a review of the research methods that can be used to conduct a study of this type and the advantages and disadvantages that are inherent in each and a justification for selecting specific units of analysis. The discussion moves to a detailed explanation of the methods that were used to analyse the data, before the chapter concludes with an acknowledgment of the ethical considerations that apply to all professional research in the social sciences and the ethical standards to which researchers are required to adhere scrupulously at all times during the conducting of their studies.

1.8.4 Chapter Four: Presentation of the principal findings of the study

The fourth chapter is devoted to a presentation of the most significant findings concerning the perceptions of mineworkers of the environmental risk to which they are exposed by working at the mine. It encompasses the perceptions and opinions of both members of the management of the company and mineworkers concerning environmental risk in mining. The findings are also aligned with the research questions and the objectives of the study, which were articulated in Chapter One. SPSS and Atlas.ti, software were used to analyse the quantitative and qualitative data respectively. The analysis of the numerical data is presented in the form of frequencies, percentages, valid percentages, cumulative percentages, means, and standard deviations, which are interpreted in the following chapter.

1.8.5 Chapter Five: Discussion and analysis of the principal findings of the study

The first part of the penultimate chapter takes the form of an analysis of the perceptions of mineworkers of environmental risk in mining, which is guided by the fundamental tenets of critical realism theory. The second part is a discussion of the findings from the standpoint of an appraisal of the difficulties that are likely to arise as a consequence of their working conditions, drawing on the literature review and the research questions. The chapter concludes with an assessment of the extent to which the aim and objectives of the study have been achieved.

1.8.6 Chapter 5b: Conclusions and recommendations

The final chapter is devoted to a discussion of the conclusions that were drawn from the findings of the study, on the basis of which specific recommendations are made, before the chapter closes with concluding remarks.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

The purpose of this chapter is twofold, as it entails a literature review, which locates the research topic within broader academic discourse, and an elucidation of the development of the theoretical framework, which enables the topic to be investigated in relation to the fundamental tenets of critical realism. Historically, the assessment and management of environmental risk, particularly in the mining sector, have tended to be dominated by experts and bureaucrats, to the exclusion of mineworkers and local people.[1] Consequently, the perceptions and opinions of mineworkers of environmental risk and the extent to which they are exposed to unacceptable levels of risk by mining activities have received relatively little attention to date (Sadler & Dalal-Clayton, 2012). The chapter commences with a discussion that draws on a number of historical sources, to develop a proper understanding of the lived experiences of mineworkers in the mining sector, particularly in southern Africa. The point of departure for this chapter is to determine how mineworkers perceive the risks that are inherent in mining activities.

Since the discovery of vast mineral deposits in southern Africa during the late 1800s, the wide range of environmental risks to which mineworkers have been exposed have stemmed largely from the severe environmental conditions in which they have been required to work. As the voices of mineworkers have been absent from discourse pertaining to the assessment and management of environmental risk in the mining sector, their perceptions of environmental risks and the extent to which their rights are ignored by their exposure to them remain largely unknown, a conclusion that provided this study with its raison d'être. To obtain a sufficiently comprehensive understanding of the experiences of mineworkers in their working environments and the types of risk to which they have been vulnerable, it is necessary to draw from their history of working in mines in southern Africa and how they have been affected by doing so (Bezuidenhout & Buhlungu, 2011).

The discussions in this chapter will proceed under the following headings:

---

[1] Local people refer to people who reside in a particular area, city, or town

(Sadler & Dalal-Clayton, 2012).

- A historical analysis of the experiences of mineworkers of environmental risk in the mining sector in southern Africa
- The concept of environmental risk within the context of environmental management systems (EMS)
- Participation by mineworkers in the making of environmental decisions
- Environmental legislation and policies in Namibia
- Theoretical framework: Critical realism theory

Drawing on both relevant available literature and insights afforded by critical realism theory enabled the researcher to identify specific shortcomings in the assessment and management of environmental risk in the mining sector at present. The ultimate conclusion of the chapter is that a more holistic approach to the assessment of environmental risk is required, which takes lived experiences of mineworkers of risks properly into account (Oelofse, 2003).

2.2 The Experiences of mineworkers of environmental risk in the mining sector (Global Overview)

XXXXXXXXXxsxsxsxsxssksjkshshgdhdhbdbdjjdjhdbdbdhdhdhdudidbidjdfkdndkdndkdndkdndnddkdjdbdhdbdjudbdhjdbdjdhdjh

2.2.1 A historical analysis of the experiences of mineworkers of environmental risk in the mining sector in southern Africa

This section is principally concerned with a historical analysis of the experiences of mineworkers, the environmental conditions in which they have been obliged to work, and their exposure to environmental risks that are inherent in mining activities, from the seamlessly merged colonial and apartheid eras until the present. A historical understanding of mining and the experiences of mineworkers in southern Africa would be incomplete without an awareness of sporadic mining activities and operations during the pre-1800 era. The sociohistorical context for migrant labour systems and the creation of a cheap labour market in South Africa dates from the late 19th century, as a consequence of the discovery of diamonds in Kimberley in 1867 and the discovery of deep-level gold on the Witwatersrand in 1886, which was to have cataclysmic consequences for indigenous populations. Crush, Jeeves, and Yudelman (1991); Crush and McDonald (2001) contend that the discovery of the gold reef in 1886 on the

Witwatersrand changed the face of the southern African landscape forever and also drastically reshaped socioeconomic relations between indigenous peoples and white settlers and representatives of colonial authority. Legislation such as the Glen Grey Act of 1894 by the Parliament of the Cape Colony was drafted and promulgated specifically to force indigenous males off their rural land and to seek employment on commercial farms and in industrial activities such as mining.

British colonial rule established a migrant labour system that became entrenched in the mining industry (Bezuidenhout & Buhlungu, 2011). The migrant labour system that the mining companies developed during the colonial and apartheid eras in Southern Africa were a fundamental feature of the gold mining industry from the start (Bezuidenhout & Buhlungu, 2011). Ignoring the grievances of black mineworkers frequently resulted in mass desertions, boycotts, and other expressions of intense dissatisfaction. The living conditions of black mineworkers were also generally almost unbearable as, in most cases, large numbers were forced to share a single room and forego any semblances of privacy (Rabe, 2006).

2.2.2 Working conditions and attention to safety considerations

The rapid development of the mining industry after the discovery of diamonds and gold in the early 1880s inevitably resulted in crude and harsh working conditions, owing to the embryonic stage of development of mining technology at the time. Black indigenous mineworkers,2 who made up the majority of the workforce, were subjected to particularly harsh working conditions. The working conditions of their white counterparts were marginally better in some respects, but the occupational diseases that are associated with mining have never respected racial or ethnic differences (Judd, Surridge, & Surridge, 2013).

Although all mineworkers were exposed to humid and damp conditions underground, black miners would inevitably have been most adversely affected by a lack of adequate protective clothing. Temperatures in the mines were extremely high and ventilation was rudimentary. These conditions, along with the dusty atmosphere underground, resulted in large numbers of mineworkers contracting and succumbing to fatal diseases such as silicosis and phthisis. As there were no roads or railway lines to transport heavy loads, the most common form of transport was ox-drawn carts, which were both unsafe and unreliable. In some extreme cases, black mineworkers were made to carry heavy loads, before a viable transport system was developed (Packard, 1989). Working hours often varied from 12 to 18 hours a day and there were numerous fatal accidents, which killed hundreds of miners in the mines (Wilson, 2011). A typical example was a fire that broke out at one of the De Beers diamond mines in Kimberley in 1888, which claimed the lives of more than 150 black miners (Kane-Berman, 2017).

In addition, black mineworkers earned low wages and were on short-term seasonal contracts, which could not guarantee permanent employment. At the time, the Chamber of Mines attempted to justify their extremely low wages by maintaining that their families were earning an income on the farms on which they were living in the rural areas. The limited duration of their employment contracts also made it difficult for black mineworkers to mobilise and form their own trade unions to campaign for improved wages and working conditions (Kane-Berman, 2017; Pelders & Nelson,2019). Working conditions were notoriously unsafe and hazardous in most mines throughout southern Africa. As the owners of mines tended to accord scant concern to safety among the priorities of the managing of their mining companies, the rights of mineworkers were frequently violated with impunity. Unsafe working conditions were also further aggravated by mining supervisors who ignored health and safety practices to facilitate reaching targets and deadlines, often for their own gain, in the form of a pay rise or promotion (Pelders & Nelson, 2019). The worst mining accident in South African history occurred in 1960 and resulted in the deaths of 437 miners after a fatal collapse some 180 metres underground in the Coalbrook coal mine of the Clydesdale Colliery, near Sasolburg (Kane-Berman, 2017).

Two other large-scale disasters occurred in 1986 and 1995. The first occurred at the Kinross gold mine in the province that is now known as Mpumalanga, in which 177 miners perished as a result of a fire that was sparked by an acetylene tank. The second took place at the Vaal Reefs gold mine near Orkney and was caused by a locomotive falling down a lift shaft, onto a cage, which caused it to plunge 460 metres to the bottom and resulted in the deaths of 104 miners. According to Kane-Berman (2017), some 35 000 men have lost their lives in the mines since the turn of the century and the yearly death toll for all mines in South Africa and other neighbouring southern African countries has fluctuated at in the region of 800, four times that of the United Kingdom.

Kane-Berman (2017) maintains that most mining fatalities have resulted from either inhaling dangerous poisonous gases that are found underground or rockfalls. This assessment bears some resemblance to the earlier one of Simons (1965, in Mason, 1980), that the chief causes of fatalities underground in South African mines were explosions, rockfalls, and transport accidents. Kane-Berman (2017) also emphasises that human factors have contributed significantly to the disasters, owing to inexperienced and untrained miners being tasked with performing dangerous operations. Bohle and Quinlan (2000) cogently point out that the managements of mining operations frequently fail to ensure that the effectiveness of safety measures keeps pace with the degree of risk that the work entails.

Rabe (2006) explains that the living conditions of black miners remained largely unchanged in South Africa from the early years until the political changes that occurred towards the end of the 20th century. She maintains that during the colonial and apartheid eras, the conditions under which black mineworkers were required to work in southern Africa were generally particularly harsh. Crush et al. (1991) explain that in response, black mineworkers started to form their own union groups, to protect their rights and improve their working conditions. Among the primary aims of the early unions was to combat harsh treatment and unfair dismissal, which were common in the mining industry at the time. Mass-dismissals frequently resulted from strikes to protest against low wages, poor working and living conditions, and poor food. The formation of the African Mine Workers' Union (AMWU) in 1941 marked the transition of the African National Congress (ANC) from a movement that patiently and politely campaigned for rights to one that began to play an active role in demanding significantly increased wages and improved conditions. It is estimated that of the order of 60 000 black mineworkers participated in the AMWU strike of 1946, to demand a minimum wage of 10 shillings a day and improved living conditions on the hostels, which were deplorable (O'Meara, 1975).

The government used draconian measures to crush the strike ruthlessly and an estimated one thousand black mineworkers were arrested for participating in it, while others either sustained serious injuries or died on the spot (Crush et al., 1991; Moodie, 1994). Conditions in many mines throughout southern Africa remained unchanged long after many African nations had achieved independence from their former colonial masters. In 1948, South Africa underwent a change of government, following the electoral defeat of the United Party, under the leadership of Jan Smuts, which resulted in the National Party assuming power, with D.F (Freund,2006). Malan as Prime Minister, an event that signalled the formalisation of apartheid as government policy. Conversely, it needs to be emphasised that South African labour policies differentiated between skilled and unskilled workers on the basis of race prior to 1948, thereby precluding the socioeconomic upward mobility of blacks who worked in positions that required skills, and resulting in their being paid substantially less than their white counterparts who performed the same types of work (O'Meara, 1975; Freund,2006).

No understanding of the lived experiences of black mineworkers in South Africa, of which Namibia, in the guise of South West Africa, was effectively a province until independence, would be complete without an adequate appraisal of the diametrically different assessments of migrant labour that were made as the 1940s drew to a close (Freund,2006). It was concluded in the report of the Fagan Commission of 1948 that it was not feasible to confine

indigenous blacks[2] to the Native Reserves, as they were overcrowded and impoverished and the greater part of the population had permanently established themselves in urban areas. Although it emphasised that it would be wrong to introduce legislation or attempt, through administrative policy, to perpetuate migrant labour and that doing so would have detrimental consequences, it nonetheless added that migrant labour could not be proscribed through legislation or ended through administrative policies or measures (Freund,2006). The ambivalence of the Fagan Report, which had been commissioned by the United Party government, stood in stark contrast with the stated or unstated vested interests of three specific business sectors.

The mine-owners, through the Chamber of Mines, had long insisted that their mines could not operate without the cheap labour that migrant labour guaranteed and frequently complained that the higher wages that black workers were able to earn in urban industries resulted in their workforces being depleted. The white-owned agricultural sector was highly dependent on large government subsidies and labour controls. As a consequence of the relatively low productivity of South African agriculture by comparison with the highly mechanised agriculture of the developed countries, farmers could not compete with the wages that black workers earned in urban industries during the war years and could not afford the relaxation of labour controls or the termination of the migrant labour system (Freund,2006). Although English-speaking whites had traditionally commanded a disproportionately large share of the national economy, strategies to accumulate Afrikaner capital were also dependent on the exploitation of the cheap labour system. As the second group were strongly represented in the new National Party government and its leadership was the driving force in the accumulation of Afrikaner capital by embarking on an entry into the domain of finance capital by means of the savings of Afrikaans-speaking workers and farmers, the change of government intensified resistance to a stabilised higher wage urban black labour force (Freund,2006).

It is of the greatest significance that as early as 1949, the Johannesburg Chamber of Commerce, in its review of government policy in relation to achieving economic growth for the country as a whole, condemned in the strongest terms the notion that either racial prejudice or sectional interests should be permitted to determine economic policy. It needs to be emphasised that the assessment had a purely pragmatic basis, as it held that it would be suicidal for a strategy to increase the national product through increasing the productivity of labour to contain provisions that prevented the members of any population groups from

[2] Native or local miners of African ancestry predominantly resided in the rural areas (CJPME Foundation, 2014)

making the greatest possible contribution to the national economy (O'Meara, 1975; Freund,2006)).

Nonetheless, the apparent intention of the Smuts government to relax labour controls aroused fear and anger among white workers, which were adroitly exploited by the National Party. Forging strong bonds with white unions and promising to prevent black workers from competing in the labour market proved to be sufficient to enable the National Party to ascend to power in 1948, a position that it was to retain until the first democratic elections in 1994 (Freund,2006). Frustrating the legitimate aspirations of populations and holding back developments that should occur naturally as societies evolve will always have consequences, although the apparent failure of the strike of 1946 resulted in significantly diminished activity among black mineworkers' unions. None of their demands was met and the prospects of a remotely appropriate minimum wage and improved working conditions were as remote as they had ever been. Black mineworkers, particularly migrant workers, have truly been numbered among the wretched of the earth, to borrow a phrase from Frantz Fanon (Crush & Tshitereke,2001). Separated from their families for extended periods, working for long hours for a pittance in gruelling and hazardous conditions, living in overcrowded quarters after their shifts, and eventually returning at the end of their contracts to the Native Reserves to live in poverty and squalor until they returned to the mines once more, to start the cycle again, effectively condemned them to an existence of perpetual limbo, whose psychological effects need to be adequately understood if a realistic understanding of their lived experiences is to be obtained (Freund,2006; Mabasa & Chinguno,2018).

The unionisation of black labour gained considerable momentum during the 1980s. At the instigation of the Council of Unions of South Africa, the National Union of Mineworkers (NUM) was formed in 1982 (Plaut & Holden,2012). Under the leadership of Cyril Ramaphosa, the present president of South Africa, its membership grew exponentially and it became the largest affiliate of the Congress of South African Trade Unions (COSATU), which was founded in 1985. Among the early achievements of the NUM were recognition as a negotiator by the Chamber of Mines in 1983 and its successful campaign during the 1980s to end job reservation on the mines, the system under which the positions that commanded the highest rates of remuneration had been reserved for white employees only (Marinovich,2016; Mabasa & Chinguno,2018). As General Secretary of the NUM, Ramaphosa was to lead the largest gold and coal mining strike to date in 1987, in which some 340 000 mineworkers participated at its height, for a living wage and decent working conditions. Although the strike was characterised by intense violence on the part of both the striking mineworkers and the security personnel of the mines and endured for three weeks, the mineworkers were eventually forced

to back down and return to work without having their demands met, or face dismissal (Mabasa & Chinguno,2018). The strike might have ended in failure, but it nonetheless demonstrated quite unequivocally the collective will of the mineworkers to articulate their grievances and seek to resolve them through industrial action.

In December of 2007, more than a decade after the first democratic elections that officially brought the apartheid era to a close, the NUM called the first nationwide mining strike in South African history, to protest unsafe working conditions in the mines. Although the government had ostensibly begun to implement a plan to reduce mining fatalities, there had been a significant rise in fatalities during the period from 2006 to 2007 (Stewart, Bezuidenhout & Bischoff,2020). The one-day strike saw all but an estimated 5 percent of the entire workforce staying away from work, with substantial reductions in annual production goals as a direct consequence of the strike being announced by some mining companies. The phenomenon also serves to underscore that negative perceptions of black mineworkers of environmental risk in South African mines remain prevalent in the post-apartheid era.

The wildcat strikes for higher wages and improved living conditions at the Lonmin platinum mine in Marikana, in the vicinity of Rustenburg, in August of 2012 took on an altogether different character from the strike of 1987, as on these occasions, the strikers came directly into conflict with both the police and the leadership of the NUM and culminated in what has been described as either a tragedy or a massacre, in which 34 mineworkers were killed, many more were injured, and more than 200 were arrested Marinovich,2016. From the evidence that has been presented at a number of trials and hearings, it appears that the violence could have been avoided if police officers who had the necessary knowledge and experience of controlling crowds and defusing potentially explosive situations had been placed in charge of the operation, in order to prevent an escalation of violence (Stewart, Bezuidenhout & Bischoff,2020). A great deal of controversy also surrounds the personal role of Cyril Ramaphosa. After leading the NUM strike of 1987 and championing the same causes as those of the Marikana strikers, by 2012 he was a businessman, a shareholder in Lonmin, and a non-executive member of its board. It has been suggested on the basis of a number of e-mail messages that he sent at the time that he used his influence in the ANC and the NUM to secure the support of the police and the union to crush what he portrayed as an instance of criminal behaviour, rather than an industrial dispute (Stewart, Bezuidenhout & Bischoff,2020). For nearly a decade, the events of Marikana have cast an enduring shadow over the plight of black mineworkers in southern Africa and their prospects of having their requests for adequate remuneration, safe working conditions, and decent living conditions met with anything other than repression. To this day, the remnants of a system that has been predicated on cheap

migrant labour can still be discerned throughout the mining industry in southern Africa. Ignoring their needs and concerns continues to result in severe hardship for black mineworkers and their families (Rabe, 2006). Rabe (2006) emphasises that the perceptions of mineworkers of their working conditions and the environmental risk to which they are exposed continue to be overlooked, despite the changes that have accompanied the use of modern technology in most mining operations and its potential for facilitating the development of safer and healthier working conditions.

2.3 The concept of environmental risk within the context of environmental management systems (EMS)

The assessment of environmental risk within the context of the implementation of environmental management systems (EMS) should take the form of social reform, with respect to specific social, historical, and cultural contexts, in an overall endeavour to minimise the damage that is done to the environment as a consequence of the activities of business organisations (European Commission, 2015). As Hyett (2010) explains, many of the risks to the environment of which the general public become aware are direct consequences of urbanisation and industrialisation. They are also associated with economic development, as the countries that are most exposed to them are highly industrialised (Elliot & Thomas, 2009). Although the overarching aim of this study is to investigate and evaluate the lived experiences and perceptions of mineworkers, the purpose of this section is to analyse the concept of environmental risk, specifically in relation to environmental management systems. Like other management strategies, such as cost-benefit analyses and environmental impact assessments (EIA), assessments of environmental risk are made to determine whether the beneficial results of a particular course of action are likely to be accompanied by excessively negative consequences, such as irreversible damage to the environment, in the cases of assessments of environmental risk and environmental impact assessments (Elliot & Thomas, 2009).

It was concluded from the findings of a study that Botta, Comoglio, Quaglino, and Torchia (2009) conducted in the region of Piedmont in Northwest Italy that the socially mediated nature of perceptions of risk needs to receive due consideration in the formulation of strategies to assess and manage risk. Of particular significance to this study is the contention of the researchers that the need for the mining sector to comply with ever-increasingly stringent environmental legislation and meet the needs of a range of different stakeholders has resulted in mining companies gradually moving away from conventional end-of-pipe approaches to controlling pollution and adopting a more holistic approach that includes obtaining an improved understanding of the perceptions of mineworkers (Botta *et al.,* 2009). Piyapong and Tsunemi

(2014) maintain that there has been a growing recognition of the limitations of conventional methods of conducting assessments of risk, insofar as they permit a multifaceted understanding to be obtained of the ways in which workers perceive the environments in which they work and assess the risks to which they are exposed in their everyday working lives. This assessment accords well with the conclusion of Botta *et al* (2009) that the socially mediated nature of perceptions of risk needs to be taken adequately into account in the development of all systems to assess and manage risk.

Botta *et al*. (2009) explain environmental risk is normally integrated into environmental management systems, as a component of a broader integrated spectrum of considerations and concerns that includes operational and monitoring procedures, environmental responsibilities, compliance with relevant legislation, and measures to prevent hazards to the health of both miners and people who reside in the areas surrounding mining operations. Figure 2.1 is a schematic depiction of the functioning of an environmental management system, which Botta *et al*. (2009) maintain has the potential not only to increase the ability of mining companies to comply with environmental regulations, but also to identify other technical and economic benefits from their operations and ensure that appropriate environmental policies are adopted and followed.

An environmental management system (EMS) can also be considered as an effective model for enabling the managements of business organisations to identify significant environmental risks, set and meet environmental goals, and comply with environmental regulations to minimise the degree of risk to which mineworkers are exposed (Botta et al., 2009). An EMS can effectively accommodate measures to ensure healthy conditions, safety, and social accountability in the mining sector, and can also provide valuable insights into potential risks to both the environment and mineworkers. Consequently, an effective EMS can also help mineworkers to improve their understanding of the environmental risk that their work necessarily entails. Kasperson et al. (1998) maintain that some bodies of theory make it possible to integrate the reviewing of risk with the social and cultural responses that shape the perceptions of employees of risk. Renn (2008) advocates the increased integration of social science perspectives, such as those of realism and constructivism, into the assessment of risk and environmental management systems, in order to incorporate the socioeconomic dimension of risk.

From the standpoint that Renn (2008) articulates, risk practitioners in mining industries urgently need to find ways to expand their sets of criteria for assessing, evaluating, and managing environmental risks beyond the largely technologically based approach to training mineworkers in accordance with existing models of risk governance (Gawaikar, Bhole, &

Lakhe, 2018). Sánchez and Hacking (2002) point out that many of the models for environmental management that are applied today evolved from ideas and concepts that were developed in the discipline of environmental risk assessment (ERA). They maintain that in order to respond to specific needs, individual mining companies need to develop their own approaches, methods, and terminologies.

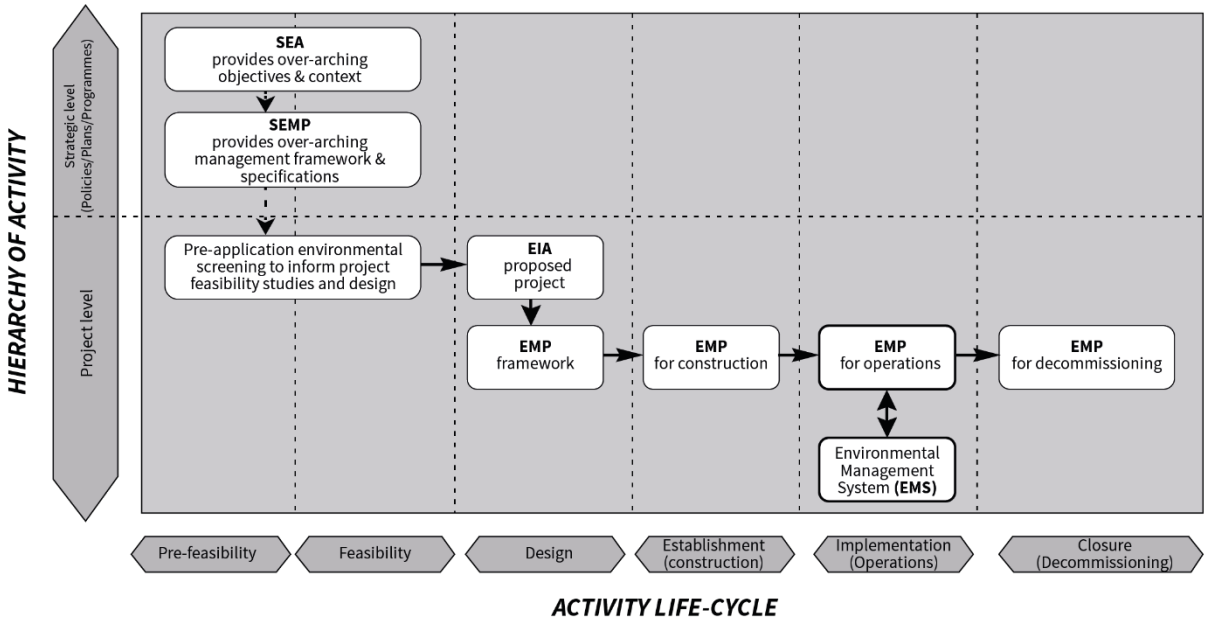


Figure 2.1: *Environmental management by means of an EMS (Carelse,2016)*

Since the dissemination of the ISO 14000n series of standards throughout the world, environmental management systems (EMS) have developed into a cost-effective means of managing environmental risk. Among their many benefits are helping to improve eco-efficiency and the public image of companies. The functioning of an EMS can be seen in Figure 2.1 (Sánchez & Hacking, 2002).

2.3.1 Managing environmental risk by means of an EMS

In a great many instances, mining operations are prone to inflicting considerable damage on the environments in which they are located and to exposing mineworkers to a high risk of falling prey to a range of occupational injuries or illnesses. The forms that the collateral damage that results from mining activities can take include the releasing of toxic or poisonous gases into the atmosphere and severe pollution as a consequence of the toxic waste and fumes that are generated, all of which have grave implications for the health and safety of miners and those who reside in the areas in which mines operate. Sánchez and Hacking (2002) contend that performing frequent assessments of risk and implementing environmental management systems provide a viable means of lowering levels of risk in mining operations.

Although ISO 14001 specifies the criteria that enable an EMS to comply with global environmental legislation and is used by a great many mining companies, it is possible to adopt other approaches to the development of an EMS, provided that its implementation results in company policy that ensures compliance with all relevant environmental legislation. Consequently, managing the risk to the environment that results from human activities of necessity entails adequate knowledge of appropriate strategies to mitigate hazards where and as they occur. Doing so requires the optimal integration and harmonising of environmental risk assessment (ERA) and EMS procedures, in the manner that is depicted in Figure 2.1. As the administrative personnel of many mining operations are not sufficiently well versed in the application of complex assessment procedures in order to monitor the health of their environments and workforces at present, it is imperative that skilled personnel who are able to implement environmental management systems to manage environmental risk should be either trained or recruited. In addition, mineworkers should also have a voice in the making of decisions pertaining to environmental considerations.

2.4 Participation by mineworkers in the making of environmental decisions

Joint participation in the making of environmental decisions enables the managements of mining operations and mineworkers to reach a consensus for improving working and living conditions, which stands to improve the safety of working conditions and increase the efficiency of operational practices. Bennett (2006) maintains that the benefits of encouraging mineworkers to participate in the making of environmental decisions include motivation from a sense of empowerment and personal autonomy and increased competence from developing an understanding of environmental risk and contributing to mitigating it. Consequently, it is in the interests of mining companies to ensure that they provide effective training in the mitigating of environmental risk, to enable mineworkers to take appropriate decisions in the potentially complex situations that they frequently encounter in their work (Lester, 2008).

Kennedy, Schafft, and Howard (2017) contend that although fair and equitable decision making is predicated on the equal representation of all interested parties, balancing the concerns and priorities of conflicting interests can be fraught with irreconcilable differences. Writing in The Times, Masondo (2010) bemoans the large-scale pollution that has resulted from the state unilaterally granting mining rights on productive agricultural land, which he maintains threatens food security. Maintaining that mineworkers should have a say in the making of decisions that affect their lives, Kennedy *et al*. (2017) suggest that appropriate legislation should facilitate equal participation through provisions that ensure that their contributions are maximised. It also needs to be acknowledged that as workers might perceive the risks to which they are exposed differently from other stakeholders, it is crucial to

understand the underlying reasons for their perceptions and to develop appropriate means for accommodating different perceptions, beliefs, or opinions in the making of decisions (Harding, 1998).

Assessments of risk, to manage and reduce the level of risk that is inherent in particular activities or operations, play a crucial role in the making of optimal environmental decisions. An assessment necessarily entails the identification of potentially adverse effects on both human beings and ecosystems (Tempelhoff, 2010). Consequently, environmental decisions are made on the basis of the conclusions of assessments of risk to minimise the adverse effects that activities such as mining operations have on environments, local communities, and employees (Morodi, 2016). It also needs to be emphasised that the perceptions of mineworkers of risk tend to be influenced to a significant degree by factors such as their awareness of the risks that their work entails and whether they expose themselves to risk voluntarily or are obliged to do so in order to remain in employment (Slovic, 1987).

Although the assessment of risk is a viable means of making decisions to prevent or limit damage to the environment, its present remit nonetheless does not extend to the many social, ethical, and cultural considerations that need to be taken into account to ensure the future safety and health of mineworkers in southern Africa. Tonn, English, and Travis (2000) maintain that participation by mineworkers in environmental decisions upholds their right to be adequately informed of the risks that their work entails for them and the environment and their right to comment on and challenge the decisions of the managements of their companies pertaining to environmental considerations.

2.5 Environmental legislation and policies in Namibia

The government of Namibia has demonstrated a strong commitment to regulating the environmental risk that results from mining activities and has enacted many laws and pieces of legislation to curb or curtail any wrongdoing by mining companies in order to preserve the environment. Guided by the Intergovernmental Forum on Mining, Minerals, Metals, and Sustainable Development (IGF), Namibia has developed several policies pertaining to mining that are intended to ensure the sustainability of the environment. These laws and policies are regularly updated, to ensure that they remain relevant to the needs and interests of Namibian society and minimise environmental risk. Not only do these mining policies and pieces of legislation provide a sound basis for formulating appropriate environmental legislation, but they also provide industries such as mining with an appropriate orientation for managing risk, by clearly articulating the types of measures that need to be implemented to ensure the sustainability of the environment (Mansfeld, 2006). Some of the environmental legislation

policies that have been enacted in Namibia specifically stipulate that the mining of mineral resources in an area should be carried out in a manner in which the sustainability of the environment is ensured, by not causing harm, the degradation of land, or the creation of wastelands.

2.5.1 The Environmental Management Act, No 7 Of 2007

The government of Namibia promulgated the Environmental Management Act (Act 7 of 2007) (EMA) as a component of its environmental legislation and policies and it was gazetted, along with the Environmental Impact Assessment Regulations, in February of 2012. Its principal purview is mining activities, specifically with respect to the management of the environment. The act prohibits the commencement of mining activities before the issuance of an environmental clearance certificate (ECC). It details the procedures that need to be followed by prospective applicants prior to being granted an ECC. The procedures include the development of an environmental management plan (EMP) and the preparation of an initial scoping report concerning the anticipated consequences of the proposed activity for the environment, local communities, and other interested or affected parties. An environmental impact assessment (EIA) also needs to be carried out by an appropriately qualified and accredited environmental assessment practitioner (EAP). An ECC needs to accompany applications for new mining licences and renewals of licences that have expired.

2.5.2 Policies and legislation for mining in Namibia

In Namibia, the Ministry of Environment and Tourism (MET), in collaboration with the Ministry of Mines and Energy, is responsible for the implementation of policies and legislation to ensure that mining and prospecting do not inflict significant irreversible damage on the environment (IGF Mining Policy Framework, 2018). The sections that follow are devoted to discussions of the legislation and policies that have been formulated to regulate the compliance of mining operations with environmental legislation in Namibia.

2.5.2.1 The Minerals (Prospecting and Mining) Act, 1992 (33 of 1992)

The Minerals (Prospecting and Mining) Act, 1992 (33 of 1992) applies to reconnaissance, prospecting, mining for, disposal of, and the exercise of control over, minerals in Namibia and related considerations. It stipulates the measures that are required to be taken to protect the environment at each stage of the exploitation of minerals. Exploitation and mining are regulated through the granting of non–exclusive prospecting licences, mining claims, exclusive reconnaissance licences, exclusive prospecting licences, mineral deposit retention licences, and mining licences (IGF Mining Policy Framework, 2018). The act makes provisions

for ensuring the protection of the environment through the mandatory carrying out of EIAs prior to the commencement of all proposed exploration and mining projects.

2.5.2.2 The Environmental Assessment Policy (1994)

The objectives of the Environmental Assessment Policy (1994) are to promote economic sustainability while ensuring the long-term protection of the environment. Without clean air, water, and soil, and the natural resources that the country has at its disposal, there would be few prospects for future generations of Namibians. Figure 2.2 is a diagrammatic representation of the stages through which a proposal to carry out mining activities is required to pass in Namibia.

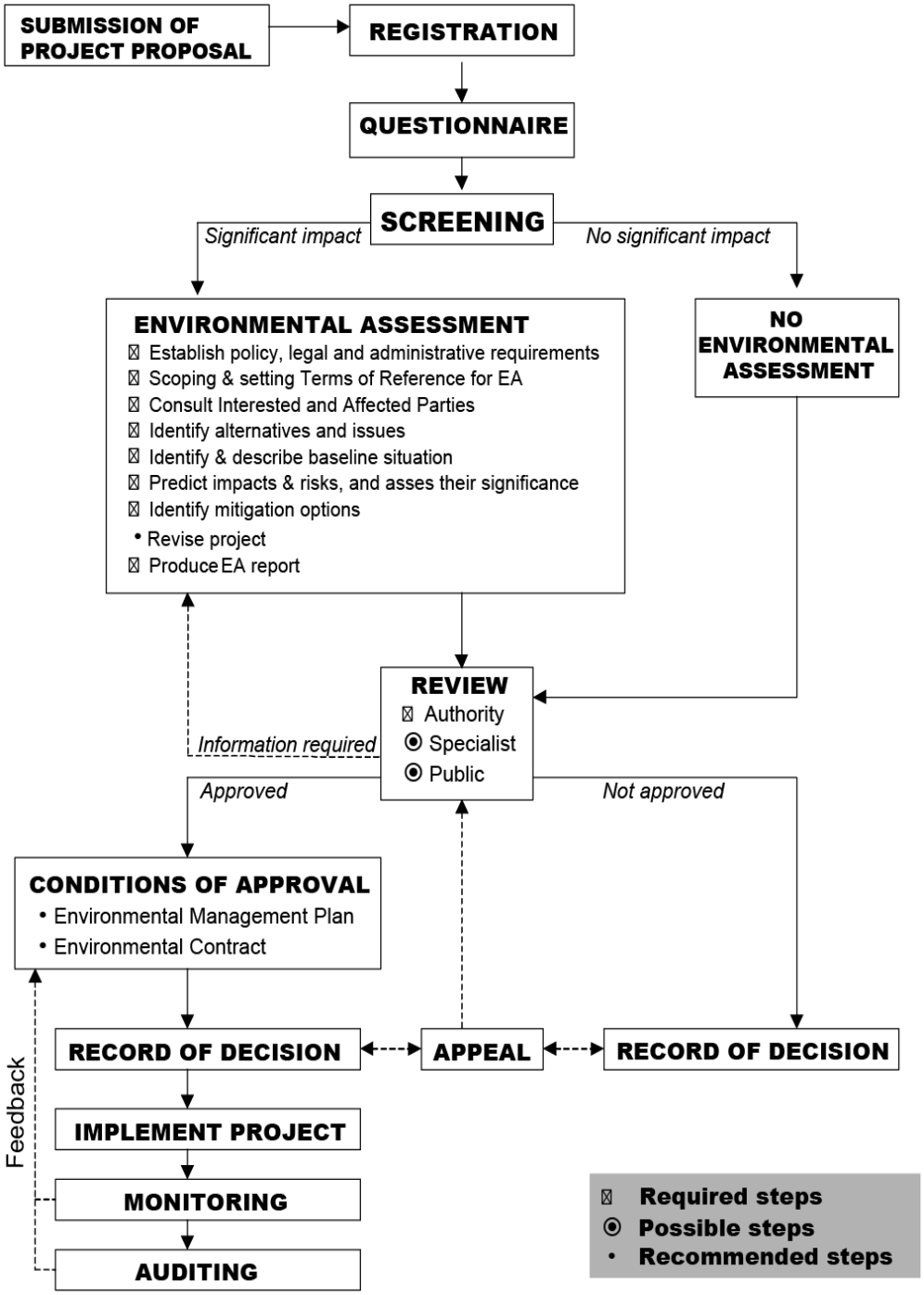


Figure 2.2: *Schematic depiction of the sequence of stages through which a proposal is required to pass, in accordance with the Environmental Assessment Policy of 1994 (Government of the Republic of Namibia, 1995)*

The Environmental Assessment Policy (1994) stipulates that once a project has been approved, the government of Namibia and the private enterprise concerned are required to enter into a binding agreement whose provisions are based on the procedures and recommendations of the EA, to ensure that measures to mitigate risk and other recommended measures are accepted and complied with by both parties. Appendix A of the policy details the sequential steps, from the submission of a proposal for a programme or project, the

formulation of a scoping report, the reviewing of the proposal by interested or affected parties, the recording of a decision, and finally the option to appeal a decision that has been recorded (Namibia, 1994).

As Mansfeld (2006) explains, the Environmental Assessment Policy ensures that the environmental consequences of a proposed development are understood and appropriate measures to minimise the effects of undesirable consequences are incorporated at the planning and decision-making stages. She also explains that all of the proposals for activities that are required in Appendix B of the policy need to be accompanied by completed environmental questionnaires and submitted to the relevant authorities, who will decide whether an EIA will be required or not. Should an EIA be required, the procedures that are depicted in Figure 2.2 would need to be followed. Conversely, should an EIA not be required, an ECC can be issued immediately, with or without conditions (Namibia, 1994).

2.5.2.3 The Minerals Policy of Namibia

The Minerals Policy of Namibia stipulates that all mining activities and their development in the country should be environmentally friendly, by taking the health and safety of local people in the areas in which mining takes place adequately into consideration. This policy commits the government to monitoring all mining activities within the country, under the auspices of the government of the Republic of Namibia. The government ensures that all mining activities in environmentally protected areas comply with the minerals policy, including its environmental and regulatory framework (IGF Mining Policy Framework, 2018). The minerals policy also articulates the commitment of the government to accomplishing several objectives that accord with the country's national development goals (IGF Mining Policy Framework, 2018; Namibia, 2004a).

In addition, the policy requires all mining companies to be fully responsible for minimising the degradation of land and the effects of other sources of environmental pollution. Mining companies are required to take full responsibility for ensuring that members of communities that are located in areas in which mining activities take place are not exposed to any harmful effects. Mining companies are required to engage with members of local communities, by contributing to the empowerment of previously disadvantaged population groups and promoting gender balance and equality (IGF Mining Policy Framework, 2018; Namibia, 2004a). The policy also prioritises the promotion and development of socially responsible small-scale mining operations, particularly in areas in which large-scale mining is not cost-efficient (IGF Mining Policy Framework, 2018). Finally, the policy places considerable emphasis on closure plans, with respect to effective environmental management.

2.6 Theoretical framework: Critical realism theory

According to Oelofse (2003), critical realism theory provides a highly relevant and effective means of analysing environmental risk. It emphasises the structures that underlie risk events, together with the locally experienced conditions that influence and shape final outcomes (Karasar, 2005). Oelofse (2003) maintains that applying critical realism theory has been met with intense resistance from proponents of the scientific approaches that have long dominated the use of environmental management systems to determine and understand risk.

Applying critical realism theory to environmental risk necessarily implies that there is a stratified and differentiated world that is made up of events, mechanisms, and structures in an open system that is associated with complex interactions between structure and structural representations, whose outcomes will provide answers to questions concerning the nature of those interactions (Cloke, Philo, & Sadler 1991:146). This perspective requires that assessments of risk should give due consideration to the mechanisms and conditions that shape the environmental risk that particular mining activities entail. As causal mechanisms and contingency conditions could vary significantly in different industries, nations, and regions, it is necessary to investigate specific cases, in order to make accurate and meaningful assessments of risk (Gürsoy *et al.,* 2008). Accordingly, the causal mechanisms and contingent conditions that shape environmental risk in mining will be discussed in detail in the sections that follow.

2.6.1 Critical realism

Critical realism holds that as reality exists independently of human perceptions, it needs to be subjected to critical evaluation in order to understand environment risk (Rousseau, Manning, & Denyer, 2008:20). The characterisation by Cloke *et al.,* (1991:146, cited in Oelofse, 2003:2) that critical realism assumes a stratified world that is made up of different mechanisms, events, and structures that has been cited in the previous section also includes the contention that they reproduce and sometimes transform interactions between structures. From a similar standpoint, Oelofse (2003) cites Tsang and Kwan (1999), who, from the perspective of critical realism, contend that the replication of studies performs a necessary function in the accumulation of scientific knowledge, even though leading scholarly journals in management and organisational studies in fields such as information systems (IS) research explicitly avoid replication studies. Mir and Watson (2001) emphasise that critical realists do not distinguish correlation from causality, as they are primarily concerned with the power of intrinsic and extrinsic contingencies that result in correlations between observed phenomena. This conclusion suggests that research findings should not be generalised, unless they can be

replicated using different samples, populations, and research methods. Tsang and Kwan (1999) hold that the ability to replicate the results of empirical tests is an optimal means of confirming their veracity.

The central tenet of realism, that the world exists independently of human perceptions and the ways in which events, occurrences, and phenomena are conceptualised, places it at variance with the insistence of positivist thought in the social sciences, that whatever can be said to exist can be verified through empirical methods such as observation, experiments, mathematical calculations, or exercises in logic. Conversely, realists would be inclined to criticise expressions of positivist thought for their reliance on empiricism and rejection of the significance of the role of underlying structures. From an epistemological perspective, realists do not aspire to the universalist claims of positivism, but instead conceptualise knowledge as a product of social and historical forces, which can be specific to a particular period of time, culture, or situation (Robson, 2002). Oelofse (2003) explains that for realism, as it is for all critical and radical approaches in the social sciences, the production of knowledge occurs as a consequence of identifying the structures and relations that underlie the social world. Accordingly, the researcher elected to evaluate environmental risk in this study in relation to the causal mechanisms that shape risk events and the contingent conditions that provide the contexts within which they occur. The findings of the studies that were conducted by Watts and Bohle (1993), Oelofse and Dodson (1997), and Oelofse (2003) all demonstrate how the action of causal mechanisms and the influence that socioeconomic and political factors exert in particular sets of contingent conditions can precipitate the occurrences of hazardous events in different local contexts.

The publication of the study that Oelofse (2003) conducted in an informal settlement in South Africa provides a detailed explanation of contingent factors as the agents that represent the temporal and local variations that influence how risk is experienced, thereby providing a pictogram of the features of a particular location that shape a risk event and the responses of people to it. In doing so, it provides a comprehensive explanation of the extent to which the concerns of critical realism differ from those of the dominant technical and scientific discourse that usually determines the understanding of risk. Oelofse (1994) credits Bhaskar (1975) with coining the aphorism that although realism holds that there is a real world, the most significant components of this world are not immediately observable.

It follows from the foregoing discussion that to understand the subjective perceptions and experiences of mineworkers of the environmental risks that are entailed in their work from the perspective of critical realism, it is essential to understand the hidden causal mechanisms and contingent conditions on which environmental risk is predicated. As the environmental risk to

which mineworkers are exposed by the operations of the Walvis Bay Salt Holdings company is determined by political, social, economic, and biological or biophysical factors, these factors and the degree of influence that they exert on environmental risk need to be adequately evaluated (Oelofse, 2003). They can be interpreted as domains of reality, as the actual, the real, and the experiential forces and events that shape environmental risk (Bhaskar, 1978).

Schematic representation of the interactions between underlying mechanisms and contingent conditions in the realist paradigm

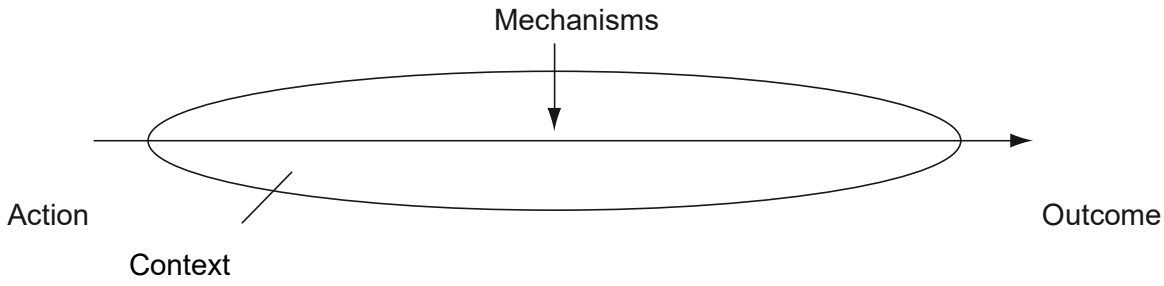


Figure 2.3: *Schematic representation of the interactions between underlying mechanisms and contingent conditions in the realist paradigm (Robson, 2002)*

As political factors have encouraged mineworkers to believe that mining is beneficial, in the senses that it provides them with gainful employment and stimulates the national economy, they are likely not to give a great deal of consideration to the harm that mining activities could inflict on the environment. As it is equally likely that factors such as age, gender, and levels of poverty have a significant influence on perceptions of and attitudes to risk, it could be logically assumed that they would exert a similar influence on the perceptions and attitudes of mineworkers. This conclusion implies that the ways in which people think or behave, or perceive environmental risk, are likely to be influenced by their immediate concerns, such as the need to find employment and earn a living. Concerns such as the future of the environment are likely to appear abstract and remote in the face of more personal priorities. Critical realism provides the means to evaluate the perceptions of mineworkers of the phenomena that affect their lives, such as environmental risk, against the backdrop of the interplay of unseen causal mechanisms and contingent conditions. The sections that follow are devoted to discussions of causal mechanisms and contingent conditions, specifically in relation to their significance for critical realism theory.

2.6.1.1 Causal mechanisms

Causal mechanisms can vary in accordance with the models that are adopted to analyse responses to social phenomena by making use of the critical realism research paradigm.

Oelofse (2002) used seven causal mechanisms in her model to analyse environmental risk. Although these mechanisms were identified in relation to urban environmental risk, they nonetheless have a definite bearing on the mechanisms that play a role in environmental risk in mining operations. Oelofse & Dodson (1997) define causal mechanisms as the underlying structures that describe the development and occurrence of risk events in society. The functioning of causal mechanisms can be influenced by many different factors, including socioeconomic and political factors. As it can be seen from the diagram in Figure 2.4, causal mechanisms will be discussed with respect to the social sphere of the environment, globalisation and urbanisation, poverty and vulnerability, the spatial dimension of risk, the social construction of risk, and political governance. In instances in which the interplay between the influence of particular causal factors and specific contingent conditions reaches a critical level of intensity, environmental disasters can be precipitated (Esa, 2010).

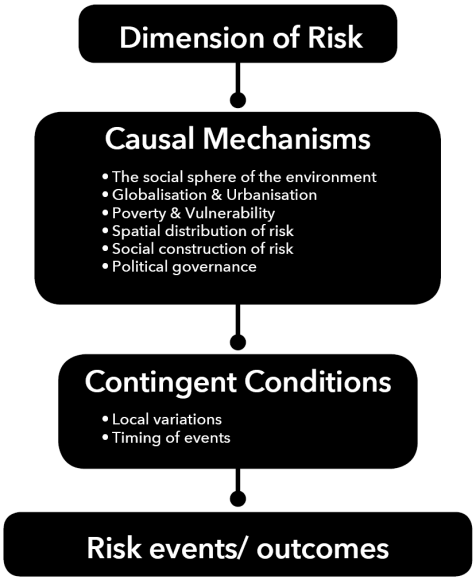


Figure 2.4: *Dimensions of risk (Oelofse, 2003)*

2.6.1.2 The social sphere of the environment

The role of the environmental social sphere in environmental risk stems from the consequences of interactions between human beings and an environment that contribute to changes in its functioning (Bass, 2000). Bass (2000) contends that human beings are of necessity highly reliant on the environments in which they live and work, as their environments provide both the food that nourishes them and the livelihoods that sustain them economically. Conversely, some uses of the environment can have dire consequences and severely, or even

fatally, undermine harmonious coexistence between human beings and their environment (Esa, 2010).

2.6.1.3 Urbanisation and globalisation

Urbanisation and industrialisation have exerted a profound influence on the perceptions of workers of environmental risk, possibly to the extent of blinding them to it (Mink, 1999). Bass (2000) contends that urbanisation has resulted in a significant shift away from agriculture as a predominant economic activity and a diversification into other fields, such as manufacturing, commerce, administration, and trading, which can account for 65% or more of urban populations. In a great many instances, urbanisation is dramatically accelerated by large influxes of people from rural areas to the cities to seek employment, which often results in urban sprawl, which, in turn, often has undesirable consequences such as increased pollution, congested traffic, the proliferation of slum areas, and overloaded infrastructure.

In several areas of the developing world, including southern Africa, the effects of rapid urbanisation have been further compounded by globalisation. It has frequently been pointed out that the benefits of globalisation are not equal for all countries. The exploitation of the resources of developing companies by multinational corporations often has severe consequences for the environments of those countries, in forms such as deforestation and pollution. In these instances, the poorly paid members of indigenous populations, in return for the ostensible benefit of obtaining employment, act as the enablers of the despoiling of their countries, apart from the hazards that unhealthy working conditions and poorly remunerated long working hours pose for their health and well-being. The benefits of globalisation do not reach those whose role is confined to sweated labour, whose lack of knowledge, experience, and training often preclude them from understanding the level of risk to which they are exposed or the damage that they are doing to the environment at the behest of foreign interests (Douglass, 1998).

2.6.1.4 Poverty and vulnerability

Dramatic increases in the sizes of urban populations inevitably result in fierce competition for the opportunities for employment that are available, high rates of unemployment, and widespread poverty. Satterthwaite (2003) maintains that poverty is an amalgam of several interrelated manifestations of deprivation, namely, inadequate and unstable income, precarious assets with respect to both material and non-material resources, poor living conditions, and limited or no bargaining power in relations with employers. These aspects of poverty have contributed to the level of risks to which mineworkers in the mining industry are exposed. Conversely, poverty also informs the perceptions of individual mineworkers of risk

and influences the choices that they make to work in mines, despite the awareness in their communities of the occupational diseases that miners are prone to contract and loss of life as a consequence of mining accidents. Bass (2000) holds that the levels of poverty in which people live are the principal determinants of the levels of risks to which they are willing to expose themselves to earn money.

2.6.1.5 The spatial distribution of risk

The proximity of the living quarters of mineworkers to the mining environments in which they work exacerbates their exposure to the risks that their unhealthy working environments entail. The tendency of the perceived financial benefits of employment in mines to incline mineworkers to disregard the degree of risk to which they are exposed accords with the definition of Oelofse and Dodson (1997) of a causal mechanism in the playing out of environmental risk in the critical realist paradigm that is depicted in the diagram in Figure 2.3.

2.6.1.6 Social construction of risk

Social constructions of events, occurrences, or phenomena result from a consensus among groups of people concerning how they are perceived or understood. Accordingly, social constructions of risk among mineworkers concern their shared beliefs, opinions, and perceptions of the risk to which they are exposed and the potential harm that their work in the mines can inflict on the environment. Socially constructed beliefs, opinions, and perceptions are inherently subjective in nature and do not necessarily accord with the real world that is central to critical realism theory. As the majority of mineworkers have tended to be inadequately informed concerning environmental risk, they remain vulnerable to the hazards that are inherent in their work, in both their working conditions and their living conditions (Lofstedt & Frewer, 1998; Von Kotze, 1999). It has emerged from the findings of several studies that most mineworkers have little understanding of how they should manage the risks to which they are constantly exposed, as a result of limited formal education and a lack training in the management of risk. Consequently, as they are unable to articulate their need for improved and safer working conditions, they remain vulnerable throughout the durations of their contracts. Obtaining a sufficiently comprehensive understanding of the conditions under which mineworkers work requires a theory that is able to integrate the technical assessment of risk and the sociocultural factors that shape their perceptions and experiences of it (Kasperson *et al*., 1998).

2.6.1.7 Political governance

Political governance influences the degree of risk to which mineworkers are exposed, as it is the mechanism by means of which decisions are made to formulate policy. Newell and

Paterson (2010) explain that political governance exerts a considerable influence on both environmental risk and, as a direct consequence, the health and interests of local populations. When policies prioritise profitability over all other considerations, local environments are likely to be severely adversely affected, if not destroyed, and the health and safety of mineworkers and local populations severely compromised. The causal mechanisms that have been discussed permit the development of an understanding of how risk is shaped by specific causal factors, which interact which factors that are predicated on contingent conditions, in a dynamic relationship that can precipitate immense risk to both environments and mineworkers and local populations, of which the human players could be completely oblivious. The contingent factors that influence perceptions of risk in an analysis that is informed by critical realism theory are discussed in the sections that follow.

2.6.1.8 Contingent factors or conditions

Contingent factors or conditions can take the form of temporal and local variations in an environment and can influence the degree of risk to which inhabitants or people who work in the environment are exposed (Eiser *et al*., 2012). Contingent conditions generally exhibit environmental characteristics that both portend risk events and the responses of people who are either likely to be affected or have been affected by them. Anilan (2014) explains that casual mechanisms can be derivatives of contingent factors because their existence is largely dependent on the conditions that shape particular types of risk, which are specific contingent factors. This assessment implies that when certain conditions exist, other factors come into play, as a result of either a conducive environment having been created or the interaction between the factors. Each of the two sections that follow is devoted to a discussion of a factor that can be considered to be a contingent condition for environmental risk.

2.6.2.1 Characteristics of mines

The characteristics of a mine have a great influence on the ways in which mineworkers perceive levels of risk in the environments in which they work, because they provide the contexts in which risk occurrences take place. In addition, perceptions of characteristics can be either the results of direct observation or socially mediated (Burgman, 2005). The circumstances that prompt the occurrence of a risk event depend, to a large extent, on the characteristics of the mining environment and the responses of mineworkers to perceptions of risk. Accordingly, the characteristics of the Walvis Bay Salt Holdings mine are the contingent conditions that can potentially interact with the causal factors that the characteristics engender. As the miners work in a noisy and contaminated environment, there is a high probability of enabling other factors to trigger hazardous events. Operating the machinery that is used in the mining of salt carries its own risks, which inevitably compound the level of risk

to which mineworkers are exposed and enable other causal factors to come into play, which could potentially result in a further proliferation of interactions between causal and contingent factors.

2.6.2.2 The timing of events

The timing of events and the temporal contexts in which risk events are played out in the mining industry needs to be considered within relevant social and political contexts, and also in relation to the different activities that shape environmental risk in mining. Critical realism theory suggests that the timing of events exerts a direct influence on environmental risk, as it exerts a great deal of influence on the outcomes and consequences of events, occurrences, and phenomena in any number of social settings (Oelofse, 2003). In addition, if the analysis of Oelofse (2003) were to be applied to the WBSH mine, the timing of events and the training of miners to respond quickly to environmental risks would require adequate resources to drive initiatives to reduce risk in mining operations. She maintains that the timing of events indirectly influences how people perceive environmental risk on the basis of their own experiences, as they contribute to the shaping of the contingent conditions within which environmental risk events occur and also the likelihood of the conditions being sufficient to precipitate risk events in reality.

2.7 Conclusion

In this chapter the researcher has attempted to provide a comprehensive introduction to the research topic. The historical overview of mining operations in southern Africa was intended to provide an appropriate basis for investigating the lived experiences of mineworkers, in order to evaluate their subjective perceptions of environmental risk. The assessment of environmental risk has been covered extensively, specifically within the context of implementing environmental management systems (EMS). Due consideration has been given to the need for mineworkers to participate in the making of environmental decisions. Legislation pertaining to mining and measures to protect local environments in Namibia and to accord with the objectives of the Intergovernmental Forum on Mining, Minerals, Metals, and Sustainable Development has been covered in detail, in order to provide an adequate appraisal of the environmental responsibilities of mining companies.

The discussion of the theoretical framework that was chosen to underpin the carrying out of this study represents an attempt to justify the choice of a theory that holds that empirical observation and measurement alone do not permit sufficiently comprehensive assessments of environmental risks to be made, as the processes through which environmental risk manifests itself are generally not sufficiently immediately apparent to permit them to be

discerned through observation or measurement alone. The following chapter is devoted to an in-depth discussion of the approach that was adopted to conduct the study and the methods that were used to collect and analyse the data from which the findings emerged.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter takes the form of an in-depth discussion of the approach that the researcher adopted to conduct the study and the methodology that was chosen to collect and analyse the data that it generated. It begins by covering the underlying philosophical foundations that guided the conducting of the study, before proceeding to the research design and methodology. Owing to the exploratory nature of the study, the researcher elected to use a qualitative case study research design, which would be supported with additional data from a quantitative study. It is widely acknowledged in research in the social sciences that mixed-methods approaches allow the weaknesses of one approach to be compensated by the strengths of the other. In addition, two or more separate sets of data allow the data that is obtained from the use of one research method to be corroborated by that of another, through triangulation.

The methodology covers the research population, the techniques that were used to select the research sample, the research instruments, and the variables that were investigated. The specific objectives of answering each of the research questions were as follows:

- How do mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine? The purpose of this question was to determine how mineworkers perceived environmental risk at the Walvis Bay Salt Holdings mine and the extent to which they perceived that their work exposed them and the environment to risk. Both face-to-face interviews and questionnaires were used to obtain insights into their perceptions of environmental risk at the mine.
- Why do mineworkers perceive the environmental risk to which they are exposed as a consequence of working for the Walvis Bay Salt Holdings mining company as they do? This question was formulated to obtain an understanding of the factors that contributed to particular perceptions of the environmental risk that working for the mining company entailed and the perceptions of mineworkers of the degree of environmental risk to which they were exposed. The qualitative and quantitative data that this question generated were obtained from interviews and questionnaires respectively.
- Which intervention strategies are being implemented at present by the management of Walvis Bay Salt Holdings (Pty) Ltd to reduce or prevent environmental risk? The principal objective of this question was to determine whether any interventions were being implemented by the management of at the time of the conducting of the study to

reduce or minimise environmental risk in the operations of the company. Data to answer this question was collected by means of interviews, questionnaires, and direct observations by the researcher, over a period of one month. The principal objective was to determine the perceptions of mineworkers at the Walvis Bay Salt Holdings mine of the degree of risk to their health and safety that their work entailed.

The research questions were formulated to enable the researcher to obtain an in-depth understanding of how mineworkers perceived the environmental risks that were associated with mining activities at the Walvis Bay Salt Holdings mine. The framing of the questions was guided by the contention of Oelofse (2003) that concerns pertaining to environmental risk, such as occupational health and safety, should be understood in terms of the causal mechanisms that shape risk events and the contingent conditions that provide the contexts in which environmental risks occur. Oelofse (2003) also maintains that perceptions of occupational health and safety, particularly in the mining sector, do not develop in a vacuum, but instead are influenced by the socioeconomic backgrounds of people and the conditions under which they live and work.

3.2 Research design and research paradigm

Research designs are central to qualitative, quantitative, or mixed-methods research, in that they determine how investigations are carried out, in respects such as the methods and techniques that are used to collect and analyse relevant data. In this study, the research design provided the researcher with a systematic means of selecting mineworkers to participate in it and processing and analysing the data that their participation in the study yielded. The researcher made extensive use of the research onion that Saunders, Lewis, and Thornhill (2007) developed to illustrate a progressively more detailed approach to the development of research methodologies in accordance with the axioms of particular philosophical orientations. Saunders et al. (2007) explain that the research onion illustrates the crucial sequences that researchers need to follow in order to develop effective strategies for collecting or gathering data from the field. They explain that each layer of the onion adds a new dimension to the nature of the inquiry that is to be conducted when it is viewed from the outside. The research onion provided an effective strategy for developing a research methodology to investigate the perceptions of mineworkers of the environmental risk that their work entailed and to which they were exposed, in a manner that enabled all of the aims and orientations of the study to be integrated as seamlessly as possible.

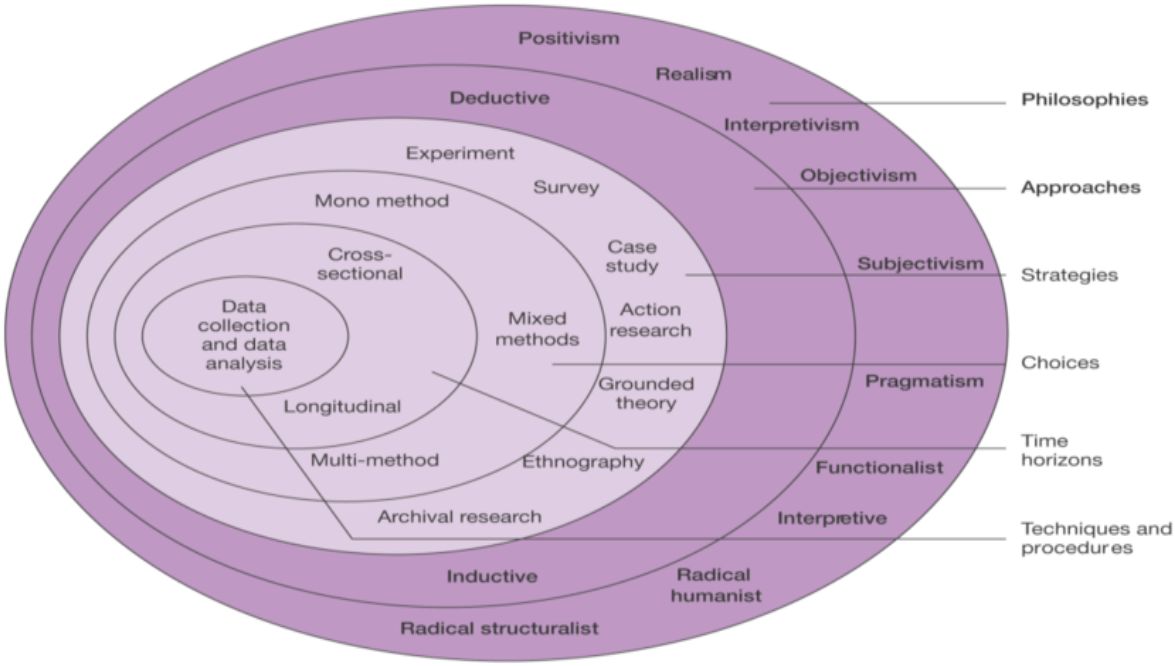


Figure 3.1: *The research onion propounded by Saunders et al. (2007)*

Although this study was located within the domain of the social sciences, its purview also overlapped with that of environmental studies. The two philosophical orientations that underpinned the planning and carrying out of the research study are discussed in the sections that follow. Underlying philosophical assumptions need to be clearly elucidated, as they provide an academically sound touchstone for evaluating the findings of research studies. As the branches of philosophy from which the orientations are derived can venture into extremely abstract territory, it is essential to provide a concise appraisal of the assumptions that are fundamental to each.

3.2.1 The ontological dimension of the research

Ontology is a branch of philosophy that is devoted to ruminations concerning the nature of existence. As a fundamental tenet of critical realism theory is that reality exists outside of human perceptions, the findings of this study need to be evaluated in relation to the dichotomy that emerges from the subjective perceptions of mineworkers of environmental risk in the mining sector and the insights that critical realism theory affords into the objective circumstances upon which their perceptions are predicated (Burrell & Morgan, 1979). This standpoint prompted a number of relevant questions, such as: Do the mineworkers make choices of their own free will in their work, or they are coerced into disregarding their personal reservations in order to remain in employment? Do external forces control their perceptions of environmental risks and their possible consequences? Are mineworkers best understood as individual people, or as a collective social system?

Another aim was to locate the experiences of the mineworkers within a particular social context and demonstrate how this social setting influenced the manner in which they perceived the environment to be associated with risk.

3.2.2 Epistemological foundations of the research study

The concerns of epistemology are complementary to those of ontology, in that they centre on the nature of knowledge and how it is acquired, as opposed to conceptions of reality. Accordingly, for the purposes of this study, the epistemological dimension of the enquiry was concerned with the phenomenology that underlay the perceptions of mineworkers of environmental risk. As Oelofse (1994) explains, the knowledge that people develop of the world is mediated by their subjective perceptions and experiences of it. An epistemological perspective enabled the researcher to ask herself questions such as how she knew what she believed that she knew about the experiences and perceptions of mineworkers of environmental risk. This question reflected an awareness on her part of the degree of potential bias that could be introduced by her own subjective perceptions of the social backgrounds and levels of education of the mineworkers. This line of reasoning enabled her to analyse the data that was obtained through the implementation of the research instruments from a realistic epistemological perspective (Burrell & Morgan, 1979).

3.3 A mixed-methods research design

A research design can best be understood as the steps or procedures that are followed by researchers to obtain relevant information concerning the events, occurrences, or phenomena in which they are interested, through the application of research methods whose reliability and validity have been established in professional research. Creswell and Plano Clark (2017) explain that both primary research, in which researchers generate their own data, and secondary research, which entails the use of data from studies that have been conducted previously, can yield valid research findings. A research methodology is essentially a combination of the procedures that are followed, the strategies that are developed, and the methods that are used to collect and analyse data that is relevant to a particular research topic. (Babbie, 2013).

A mixed-methods approach entails using both quantitative and qualitative research methods to gather data in a research study (Denzin, 2017). The adoption of a mixed-methods approach to conducting a study is an implicit acknowledgement that qualitative and quantitative research methods have specific inherent strengths and weaknesses. Using both qualitative and quantitative methods to conduct a single research study represents an endeavour to balance the weaknesses of one category of research methods with the strengths of the other, in order

to increase the validity and dependability of data that is collected (Creswell & Creswell, 2017; Denzin, 2017; Kumar, 2018). The qualitative data was analysed through the application of a qualitative inductive approach, which is depicted in Figure 3.2, and a quantitative deductive approach, in the case of the quantitative data.

Figure 3.2: *The essential orientations of qualitative research, derived from the research onion of Saunders et al. (2007)*

3.3.1 The qualitative study

The qualitative study took the form of an inductive inquiry into the perceptions of mineworkers at the Walvis Bay Salt Holdings mine (Babbie, 2013). Although it is possible to use both deductive and inductive methods to analyse qualitative data, an inductive approach provides a systematic means of guiding the analysis of data in accordance with specific research objectives (Beiske, 2007). As an inductive approach initially entails collecting data in the absence of a rigid set of objectives, other than the general objectives that are inherent in the nature of a particular research study, the ultimate objectives can be decided upon after the data has been collected (Flick, 2011). In the case of this study, the researcher began by developing a working title for the study, before she elected to develop a theoretical framework that was informed by critical realism theory, to guide the conducting of the study and the analysis of the data that was generated.

A qualitative study provided the researcher with an opportunity and the means to develop an understanding of the circumstances that gave rise to the subjective perceptions and experiences of the research population of mineworkers (King, Keohane, & Verba, 1994). Qualitative research designs and methods that draw on the constructivist paradigm enable researchers to develop richly detailed understandings of the contexts in which groups of people construct the meanings from which their subjective beliefs, opinions, and perceptions concerning their surrounding environments or particular events, occurrences, or phenomena flow (Bryman & Allen, 2011). This approach required the researcher to avoid any potential bias that could result from imposing her own perceptions of the meaning of social phenomena on those of the participants. In the words of Bryman and Allen (2001), the principal aim of the qualitative study was to conduct an in-depth investigation of how the miners interpreted their own reality.

3.3.2 The quantitative study

By contrast with qualitative research, quantitative research paradigms are inherently positivist or empiricist in nature and quantitative studies usually yield numerical data, which is analysed by means of procedures such as statistical analysis, as opposed to procedures such as thematic analysis, in the case of qualitative data (Creswell & Plano Clark, 2017). In this instance, the quantitative study took the form of a survey, which was carried out through the administration of a questionnaire. Surveys are often used in quantitative research by social scientists to gather empirical data concerning people and social phenomena (Creswell & Creswell, 2017).

When researchers in the discipline of environmental sciences elect to collect the first set of data in a mixed-methods study by means of quantitative research methods, they often commence their research by reviewing previous related research studies, acquainting themselves with existing theories that have been developed concerning the phenomena that are of interest to them, and test the hypotheses that the theories generate. They then set out to collect data to corroborate their conclusions in a real-world setting of their choice. This deductive procedure enables them either to confirm or reject the hypotheses that they have formulated, which can inform the development of subsequent research strategies (Terre Blanche & Durrheim, 1999; Welman & Kruger, 2001). Researchers who adopt a deductive approach tend to use existing theory to guide both the designing of their studies and the interpretation of their results (Neuman, 2011). Their primary objective is to verify or test a theory, rather than to develop one. One of the principal benefits of this approach stems from the ability of theories to provide a coherent provisional understanding of the phenomena in which particular researchers are interested. Theories can be effective vehicles for organising the hypotheses and research questions in studies, by serving as models that can also be applied to collecting and analysing data (Terre Blanche & Durrheim, 1999; Welman & Kruger, 2001).

Quantitative research methods enable researchers to collect accurate and precise data concerning the phenomena that they wish to investigate, in a controlled environment. The accuracy of the data that is collected can also be increased by the reliability of the research instrument, the accuracy with which the size of the research sample is calculated, and the measures that are taken to ensure that the sample is representative of the research population as a whole (Babbie, 1995; Terre Blanche & Durrheim, 1999). Conversely, although quantitative data can provide accurate and detailed information pertaining to the events, occurrences, or phenomena in which individual researchers might be interested, it also has

limitations, which need to be taken adequately into account to ensure the validity of the findings of a study.

A number of researchers have pointed out that owing to its numerical character, quantitative data precludes the possibilities of recording individual responses to phenomena under investigation. Walle (1996) contends that quantitative data undermines the ability of researchers to think in any but stark numerical or statistical terms, as the findings that it generates tend to preclude analysing data in relation to values such as freedom, choice, and moral responsibility. He elaborates by maintaining that quantification can become an end in itself, rather than a means of providing meaningful insights into the human condition. Critics tend to emphasise that it fails to recognise the unique characteristics, qualities, and attributes of individual people. It also needs to be pointed out that the adoption of a scientific approach to conducting a study cannot in fact make it a completely objective endeavour, as the very choice of a problem as being worthy of investigation and the interpretation of the findings that a study generates both necessarily entail a degree of subjectivity.

3.3.3 Reasons for adopting a mixed-methods research methodology

Choosing a mixed-methods research design enabled the researcher not only to increase both the dependability and the transferability of the findings, by allowing one set of findings to corroborate the other (Hesse-Biber & Leavy, 2010): the richly detailed data that the qualitative study generated added considerable depth and detail, and provided a meaningful context for the trends that the numerical data from the survey questionnaire suggested. It could be concluded that the integration of the quantitative and qualitative data facilitated the development of a comprehensive understanding of the perceptions and experiences of mineworkers of environmental risk at the Walvis Bay Salt Holdings mine.

The quantitative data that the administration of the questionnaire generated was subjected to statistical analysis, by means of version 26 of the Statistical Package for the Social Sciences (SPSS) software. The qualitative data that was obtained from interviews and focus group discussions in which a sample of mineworkers who were employed at the WBSH mine participated, which was augmented by direct observations, was then gathered together for thematic analysis.

3.3.4 Triangulation of the data

As it is the goal of every researcher to obtain accurate and valid data, it is common for users of mixed-methods research designs to triangulate their data, to increase its reliability through corroboration and eliminate the effects of any potential bias on the part of the researcher.

Accordingly, the researcher elected to triangulate the findings that emerged from the qualitative and quantitative studies of which this study was comprised, a strategy that enabled her to verify the two sets of findings against each other, and also to evaluate them from more than one perspective (Easterby-Smith, Thorpe, & Lowe, 1991).

3.3.5 Advantages that triangulation confers

As it has been pointed out, it is frequently beneficial to combine different categories of research methods in a single study. It is the responsibility of individual researchers to choose methodologies that will permit a clear understanding of their research topics to emerge from the findings of their studies. It is not at all uncommon to associate particular epistemological perspectives with specific methodologies (Blaikie, 1991; Decrop, 1999). Although traditionally empirical disciplines such as geography are usually associated with quantitative methods, more recent epistemological perspectives, such as humanism and postmodernism, tend to be associated with qualitative methods (Creswell, 1999).

In recent times, researchers in disciplines that fall within the purview of the social sciences have come to recognise the benefits of using more than one type of research method to conduct research studies, particularly in the aftermath of the waning of the influence of positivism and the coming to prominence of new approaches such as postmodernism (Blaikie, 1991). In addition, although policymakers have tended to display a preference for quantitative research in the past, they have gradually begun to demonstrate a heightened awareness of the role of qualitative research in informing the formulation of policy (Decrop, 1999). Triangulation implies the parallel use of techniques, to provide sets of information that overlap, which makes it possible to evaluate findings from more than one perspective. Easterby-Smith et al. (1991) identify four distinct types of triangulation:

- Triangulation of data, which entails the collecting of data at different times, or from different sources, in a single study of a phenomenon.
- Triangulation of investigators, which entails several different researchers independently collecting data pertaining to the same phenomenon and comparing findings.
- Triangulation of methodologies, which entails combining different methods of collecting data, often quantitative and qualitative methods, in a single study.

Triangulation of theories, in which a theory that has been formulated in one discipline is used to explain a phenomenon that is being investigated in another discipline.

Bowen (2003) contends that a combination of quantitative and qualitative approaches should be viewed as an acceptable methodological approach for research that encompasses a variety of epistemological positions and concerns a wide range of substantive research areas. Both Bowen (2003) and Massey (2003) characterise a mixed-methods approach as a poly-vocal approach to research, in which employing a range of methodological strategies entails researchers not necessarily privileging one particular view of the social world over another. Concurring with these and other similar assessments, many researchers in the social sciences are increasingly rejecting the automatic association of particular methodologies with epistemologies (Bowen, 2003; Massey, 2003). Instead, they tend to favour flexibility in selecting the method or methods that are most appropriate to particular research projects.

Although they are often characterised as polar opposites, quantitative and qualitative methods are not mutually exclusive and they do indeed share common ground, which is evident when their functions overlap in particular endeavours of logical inquiry (Decrop, 1999). In addition, some of the principal claims that have been made in favour of quantitative methods, such as the contention that quantitative research yields objective findings, as opposed to the subjective nature of qualitative research, have been increasingly discredited (Creswell, 1994; Decrop, 1999). Many exponents of positivist research paradigms would agree that no research can be entirely objective and free of errors, owing to the degree of subjectivity that inevitably enters into the choices that researchers make in relation to research topics and the manner in which they choose to conduct their investigations.

Although quantitative methods have been considered to be essentially deductive, in that they are often associated with the formulation and testing of hypotheses, and qualitative methods are generally associated with inductive approaches, recent assessments tend to reflect a move away from using one category of research methods only. By contending that all research entails moving from ideas to data to ideas, Bowen (2003) emphasises that researchers continually move between research questions and evidence, irrespective of the methods that they use to carry out their research. Blaikie (1991), Easterby-Smith et al. (1991), Creswell (1994), Decrop (1999), Bowen (2003), and Massey (2003) cite the following benefits of combining quantitative and qualitative research methods:

- Although quantitative research designs are intended to control bias to enable findings to be understood in an objective way, qualitative approaches are adopted to understand the subjective beliefs, opinions, and perceptions of phenomena that studies are conducted to investigate and rely on first-hand experience to provide meaningful data (Easterby-Smith et al., 1991).

- Although quantitative methodologies are used to accumulate facts in order to identify causes of particular types of behaviour, qualitative methodologies are used to understand behaviour against the backdrop of the changing and dynamic nature of reality (Bowen, 2003).
- Quantitative research designs are developed to identify and isolate specific variables in an investigation, to determine correlations, relationships, and possible causality. By contrast, qualitative designs are developed to obtain a holistic understanding of particular events, occurrences, or phenomena, by means of procedures such as document analysis, case histories, observations, and interviews.
- Quantitative data is collected under controlled conditions, to preclude the possibility that variables other than the ones in which individual researchers are interested could influence the relationships that are found, while qualitative data is collected in real-life situations (Massey, 2003).

Both quantitative and qualitative research prioritise obtaining reliable and valid findings. While quantitative researchers endeavour to obtain stable and consistent data, in the sense that they would be able to replicate their findings, the validity of qualitative findings is predicated on obtaining a sufficiently accurate and comprehensive understanding of the event, occurrence, or phenomenon that is being investigated (Blaikie, 1991; Bowen, 2003).

Mixed-methods research designs permit the advantages of each methodology to complement those of the other, to increase the validity and reliability of the findings of studies (Decrop, 1999). They enable the shortcomings of particular research methods to be contained and the factors that can affect the internal validity of findings to be identified and their influence effectively minimised. To select an optimal approach for the present study, the researcher compiled a detailed inventory of the advantages and disadvantages of the research methodologies that are used in research in the social sciences. After doing so, she decided on an integrated approach that combined both qualitative and quantitative research methods, to make it possible to triangulate the findings and ensure that the research questions could be answered as comprehensively as possible.

3.4 Research strategy

A research strategy refers to the sum and the sequence of the steps in a plan that researchers develop to guide the conducting of a research study. Strategies are usually informed by particular philosophical orientations, which determine the ontological and epistemological assumptions upon which individual research studies are based (Yin, 2011). In some cases, research questions and the nature of the problem that is to be solved also inform the choice

of the strategy that is adopted to conduct a study. Qualitative studies can take a number of different forms, one of which is the case study (Creswell, 2013). The reasons for electing to conduct a case study are discussed in the section that follows.

3.4.1 The advantages of case studies

As case studies are often exploratory in nature, they provide an effective means of collecting data concerning complex social phenomena that have not been comprehensively investigated before. Yin (2003) explains that case studies are often used when researchers wish to obtain answers to research problems that are predicated on questions that begin with “how”. There are several different categories of case studies. Some are carried out in a number of different locations, while others are comparative in nature, and some are specific to a single context. Single case studies are used to obtain answers to questions pertaining to an event, occurrence, or phenomenon that is experienced in a particular setting. They can permit researchers to develop a substantive contextual understanding of a particular setting by performing a detailed analysis of the phenomenon that occurs in it (Yin, 2003). Yin (2003) emphasises that the choice of whether to carry out a case study should be determined during the assessment of contextual conditions, in order to obtain meaningful answers to the “how” and “why” questions concerning the phenomenon that is being investigated. It was on the basis of this assessment that the researcher elected to carry out a single case study, to investigate and evaluate the perceptions and experiences of mineworkers of environmental risk at the WBSH mine, the setting in which the mineworkers had the experiences that generated their perceptions (Patton, 1990).

According to Babbie (2013), a case study is appropriate in qualitative research when researchers are interested specifically in the experiences, beliefs, opinions, and perceptions of particular groups of people in specific settings, rather than generalising their findings to other populations. Babbie (2013) points out that as qualitative research is an interpretative approach that is concerned with the subjective experiences of members of particular groups of people and the meanings that they attribute to them, the extents to which individual researchers are able to appreciate the subjective nature of their enquiries can have a significant influence on the validity of their findings. Accordingly, the researcher concluded that in the absence of data pertaining specifically to the experiences and perceptions of mineworkers at the WBSH mine of environmental risk, conducting a single case study would be the most appropriate course to follow.

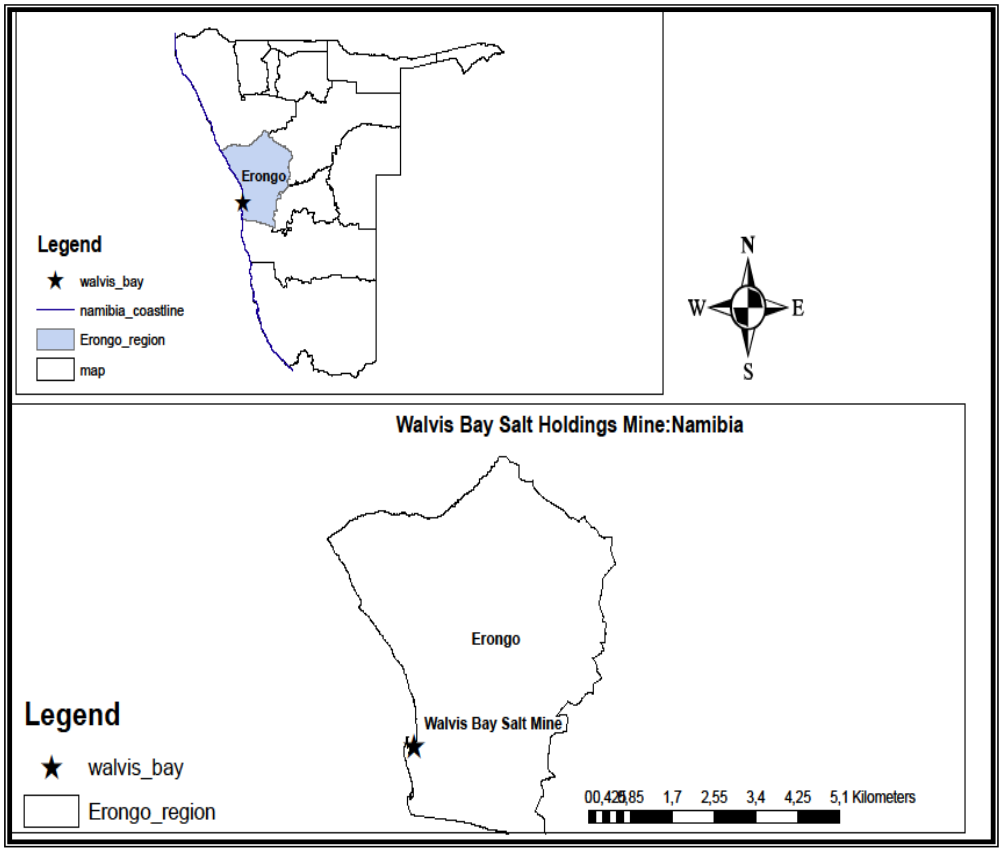


Figure 3.3: *The area in which the Walvis Bay Salt Holdings mine is located (Author, 2019)*

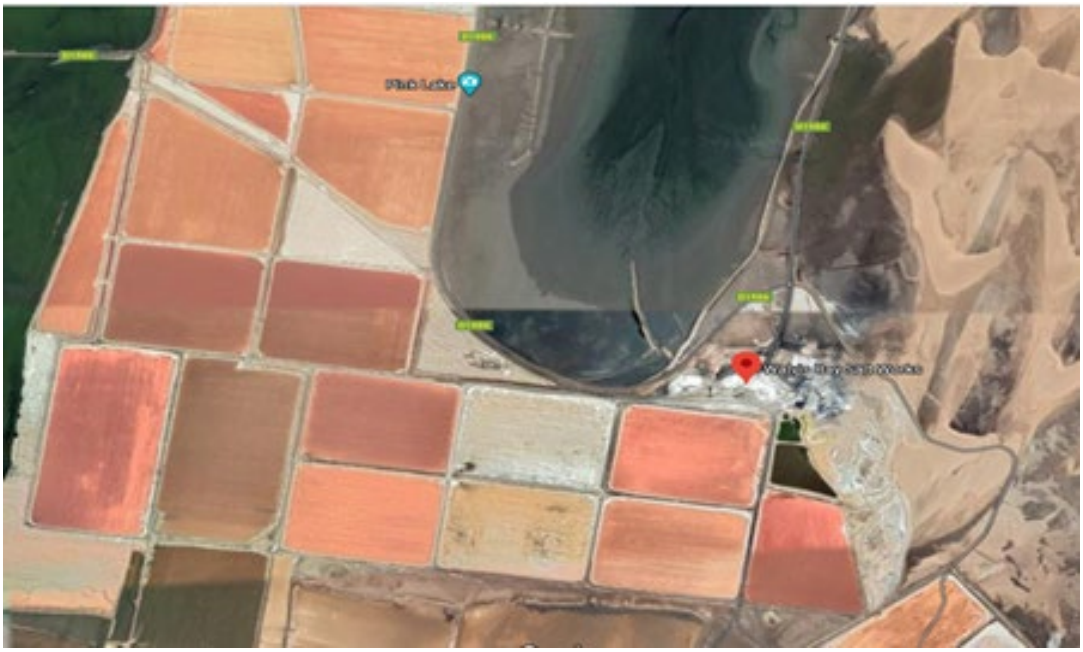


Figure 3.4: *The area in which the Walvis Bay Salt Holdings mine is located (Author, 2019)*

Table 3.1: *Criteria for selection in the research sample*

Main research question: How do mineworkers perceive environmental risk at the Walvis Bay Salt Holdings mine?					
Point of investigation	**Source of data**	**Procedures**	**Unit of analysis**	**Unit of observation**	**No. of participants**
Background, methodology, & theories	▪ Primary and secondary data	▪ Read, analyse, write, compare	▪ Journals, internet, books	▪ Published journals, trusted websites, accredited textbooks	
Causal mechanisms	▪ General mineworkers ▪ Environmental policies ▪ Management workers ▪ Coordinators	▪ Interviews ▪ Document analysis ▪ Observations ▪ Questionnaires	▪ WBSH ▪ Environmental legislation	▪ Management workers (7) ▪ General mineworkers (30) ▪ Coordinators (3)	Management workers = 7 General mineworkers = 30 Coordinators =3
Contingent mechanisms	▪ General mineworkers ▪ Environmental policies ▪ Management workers ▪ Coordinators	▪ Interviews ▪ Document analysis	▪ WBSH ▪ Environmental legislation ▪ Journals	▪ Management workers (7) ▪ General mineworkers (30) ▪ Coordinators (3)	
Perceptions of mineworkers	▪ General mineworkers ▪ Coordinators	▪ Observations ▪ Questionnaires	▪ WBSH ▪ Environmental legislation Journals	▪ General mineworkers (30) ▪ Coordinators (3)	
Environmental risk	▪ Environmental policies ▪ Management workers ▪ Coordinators	▪ Interviews ▪ Document analysis ▪ Observations	▪ Environmental legislation ▪ Journals	▪ General mineworkers (30) ▪ Coordinators (3)	
Health and safety considerations	▪ General mineworkers ▪ Environmental policies ▪ Management workers ▪ Coordinators	▪ Interviews ▪ Document analysis ▪ Observations ▪ Questionnaires	▪ WBSH ▪ Environmental legislation Journals	▪ Management workers (7) ▪ General mineworkers (30) ▪ Coordinators (3)	
				Total Participants:	**40**

3.5 Techniques and procedures

In the case of this study, techniques and procedures refer to the methods that were used to collect and analyse data pertaining to the perceptions of mineworkers of environmental risk at the WBSH mine. As it can be seen in the research onion of Saunders et al. (2007) in Figure 3.1, the collecting and analysis of data represent the core of the onion, in that they are informed successively by each layer as the development of the research study moves inwards towards the procedures that are to be followed to conduct it.

3.5.1 Unit of analysis: The target population

The most common units of analysis in sociology are individual people, groups of people, social interactions, organisations and institutions, and social and cultural artefacts. In research in the social sciences, a unit of analysis is essentially the entity that demarcates the area of concern in a particular research study. It consists of the items or objects that possess the characteristics that researchers wish to investigate or analyse, to arrive at meaningful conclusions after conducting a particular study (Bhattacherjee, 2012:65). A unit of analysis, such as a population, is a representation of the complete set of individual components in which a researcher might be interested for the purposes of conducting a research study, although it is usually not practicable for each member of the population to participate in it. Instead, the findings are usually generalised from a representative sample to the population as a whole (Gravetter & Forzano, 2009:128). In this study, the unit of analysis comprised the management of the WBSH mine, the mineworkers who were employed at the mine, including those who worked in roles such as health and safety officers, and external members of this population, such as representatives of the trade unions to which individual mineworkers were affiliated, and relevant government officials, from which a representative research sample was selected.

3.5.2 Sampling techniques: Purposive and random sampling

Sampling is the procedure by means of which researchers select a number of individual cases that possess the characteristics in which they are interested from a larger population, which is also known as the sampling frame, as representatives of it (Leavy, 2017). Consequently, it was necessary for the researcher to devise a strategy to select a research sample that would be representative of the target population whose composition was described in section 3.5.1. (Sarantakos, 1998; Hennick, Hutter, & Bailey, 2011). Strydom (2002) explains that although a sample is made up of individual members of a population who possess attributes that are central to the concerns of a study, it can also be considered as a subdivision of a population in which a researcher is particularly interested. The researcher made use of both purposive

or non-probability sampling and random or probability sampling techniques to select a research sample of 40 participants to reflect the composition of the target population. While random sampling was used to select mineworkers from the target population, purposive sampling was used to select participants who possessed specialised knowledge concerning the operations of the company.

Data was collected from 02 March to 26 August 2019. It was found that all of the officials, supervisors, and members of the management understood both English and Oshiwambo, the local indigenous language. Interviews were conducted in English and interpreted in Oshiwambo for the mineworkers who found it difficult to express themselves in English. Each interview had a duration of from 25 to 40 minutes. Although most of the mineworkers who were approached were willing to participate in the study, some referred the researcher to the team leaders in their department, as they feared that they might be dismissed if they were observed entertaining strangers. All of the supervisors and members of the management who were selected for the research sample had expressed their willingness to participate in the study. As it became evident that some of the mineworkers feared that the researcher had been sent by officials in the management to try to gather information that could be used against them, she took care to assure them that any information that they provided would be treated as strictly confidential and that their participation would be completely voluntary, as they could refuse to participate or withdraw their participation at any time, without negative consequences of any sort whatsoever.

3.5.2.1 Purposive sampling

Purposive sampling, which is also known as non-probability or judgemental sampling, is used when researchers elect to rely on their own judgement to select participants on the basis of their ability to provide information that will yield relevant data (Morse, 2010; Patton, 1990). The researcher made use of purposive sampling in this study to select knowledgeable informants for the qualitative study. Making use of the variant of non-probability sampling that is known as snowball or referral sampling enabled the researcher to draw on the knowledge and experience of employees of the company to direct her to colleagues whom they knew would be able to supply highly relevant information, a strategy that proved to be cost-effective and enabled the researcher to minimise the effects of the constraints that were imposed by a limited amount of available time (Morse, 2010; Bryman, 2012).

The criteria that were used to select the participants for the qualitative study were threefold: mineworkers and members of the management needed to have worked at the WBSH mine for a stipulated period, to reside within the surrounding areas, and also to be sufficiently

knowledgeable concerning the operations of the WBSH mine to provide richly detailed information. Those who met these criteria were asked if they would be willing to participate in the study. Creswell and Plano Clark (2011) emphasise that purposive sampling allows researchers to select participants whose knowledge, experience, backgrounds, and positions make them ideal informants. The researcher also gave due consideration to the qualities of informants that Bernard, Wutich, and Ryan enumerated, namely, availability and willingness to contribute and the ability to communicate experiences and opinions in a clear, expressive, and considered manner.

A research sample that comprised 40 participants was selected for the qualitative study. It comprised 22 mineworkers, ten representatives of unions, two key informants, from the Municipality of Walvis Bay and the Ministry of Mines and Energy, three members of the management of the WBSH mine, and three supervisors, from the Ministries of Environment, Forestry, and Tourism, Health and Social Services, and Mines and Energy. The number of mineworkers was determined by the number who were available during the collecting of the qualitative data, as most were working shifts at the time. The members of the management, senior staff, and the officials were approached well in advance, to allow the researcher to schedule the interviews at times that were convenient for them. Letters from Walvis Bay Salt Holdings (Pty) Ltd and the Mineworkers Union of Namibia to confirm that the researcher received permission to conduct the study appear in the appendices, as Appendix G and Appendix H respectively.

3.5.2.2 Random sampling

Random or probability sampling, which entails each member of a research population having an equal probability of being selected, was used to select the participants for the quantitative study (Creswell, 2009). Random sampling enabled the researcher to select a relatively large sample of respondents to the survey questionnaire from a large population of mineworkers in the shortest possible space of time. Bazeley (2009) emphasises the need to carry out sampling procedures sufficiently rigorously to ensure that they are truly representative of target populations, to permit accurate and relevant data to be gathered, and also to minimise the influence of any potential bias.

3.6 Methods employed to collect primary and secondary data

As this study was comprised of a qualitative and a quantitative component, the researcher collected relevant data by means of both qualitative and quantitative research methods. In addition, the researcher made use of both primary and secondary data. The procedures that were followed to collect the data are explained in the sections that follow.

3.6.1 Sources of primary data

As Bryman and Bell (2007) explain, primary data is the information that researchers gather directly from the sources that they have chosen. In the case of this study, the primary data was obtained through the administration of a survey questionnaire, the conducting of in-depth face-to-face interviews, and the holding of focus group discussions (Bryman, 2012).

3.6.1.1 The administration of the survey questionnaire

The survey questionnaire that was developed to collect the quantitative data was comprised of two categories of questions and statements. The first required the respondents to provide demographic details, such as their ages, genders, the levels of education that they had attained, their incomes, the positions that they held at the mine, and their daily duties. The statements in the second category were formulated to ascertain their perceptions of environmental risk at the mine and its implications for their health and safety at the mine. The respondents were requested to assign values of from 1 to 5, according to a five-point Likert scale, to indicate the degree to which they either agreed or disagreed with each statement. The contention of both Maree (2007:164) and Saunders et al. (2009:378) that although Likert scale statements enable respondents to provide valuable insights into their perceptions of the events, occurrences, or phenomena in which researchers are interested, that they cannot provide valid explanations for why they rate particular statements as they do constitutes an implicit acknowledgement of the value of the richly detailed information that qualitative research methods can generate to augment the findings of quantitative studies.

3.6.1.2 The in-depth face-to-face interviews

A one-on-one face-to-face in-depth interview is essentially a conversation between two people that is initiated by an interviewer for the specific purpose of obtaining relevant information (Creswell, 2009). In-depth face-to-face interviews are often used in qualitative research to obtain insights into the subjective beliefs, opinions, perceptions, and attitudes of interviewees concerning the phenomena in which researchers are interested (MacDonald & Headlam, 2009). To stimulate the eliciting of data, the researcher endeavoured to establish a comfortable rapport with each interviewee (Wahyuni, 2012). The interviews were conducted in either English or Oshiwambo, in accordance with the preferences of each interviewee.

The interview guide comprised semi-structured questions, which enabled the researcher to probe for additional information and to ask interviewees to clarify their responses if they appeared to be either ambiguous or to lack detail. The interviews had an average duration of from 25 to 40 minutes. Each interview was captured on audiotape, for which permission was

sought from the interviewees before the interviews commenced (Mack, 2005). Recording the interviews enabled the researcher both to correct any erroneous impressions that she might have gained during the interviews and also to formulate possible follow-up questions for subsequent interviews.

3.6.1.3 Focus group discussions

Both Sherraden (2001) and Morgan (2002) characterise focus group discussions as a means of collecting qualitative data through interactions among groups of people, by observing their behaviour and discerning their thoughts, attitudes, opinions, beliefs, and perceptions of the events, occurrences, or phenomena in which particular researchers are interested, to obtain in-depth and detailed information. Although the focus group discussions were relatively unstructured, the researcher, acting in the role of the moderator, formulated open-ended questions to move the discussions towards points and topics that were of particular relevance to the study. Four focus group discussions were held, each of which comprised from four to six participants. Although some groups comprised only mineworkers, others were made up of members of the management of the mine and government officials who worked in the mining sector. The discussions generated a variety of viewpoints and stimulated enthusiastic participation (Sherraden, 2001).

The principal purpose of the focus group discussions was to increase the validity of the quantitative data that was obtained from the administration of the questionnaire. The researcher was able to interact freely with the participants throughout the discussions and to encourage them to speak as freely and openly as possible (Krueger & Casey, 2000). The success with which the discussions were managed and motivated was demonstrated by the willingness of each participant to make significant contributions to them (Sheridan & Storch, 2009; Finch & Lewis, 2003). Accordingly, the researcher endeavoured to allow as much relevant discussion as possible to be generated from within the groups, while at the same time she strove to moderate the discussions in a manner that ensured that the objectives of the research study could be met (Finch & Lewis, 2003).

Owing to the wide range of topics that can be covered in a single focus group discussion, it is essential to document the discussion for subsequent reflection, preferably by means of an audio recorder, to capture discussions in their entirety (MacDonald & Headlam, 2009; Mack, Woodsong, MacQueen, Guest, & Namey, 2005). In this study the researcher recorded each of the focus group sessions, after having obtained permission to do so from the participants.

The flexibility of the discussions allowed relevant points that the researcher had not considered beforehand to be covered and also permitted her to probe for clarification and additional details, instead of taking particular comments at their face value (Sherraden, 2001; Finch & Lewis, 2003). Enabling the mineworkers to express themselves in their home language served to remove any potential language barriers and encouraged them to express themselves freely and to describe their experiences in detail, which allowed the researcher to collect rich data that contained vivid accounts that attested to their perceptions and experiences of environmental risk at the WBSH mine.

The researcher exercised due diligence by heeding the contention of Mack et al. (2005) that probing requires practical knowledge of the dynamics of focus groups, patience, and the effective management of time. Accordingly, she prepared herself for the discussions by ensuring that she was conversant with the range of topics that were to be covered in each discussion, in order to preclude the possibility of allowing the discussions to digress into irrelevancies. She also took care to arrive early for each session, to ensure that each discussion commenced and ended at the scheduled times.

3.6.1.4 Observations

The researcher also made use of direct observations to provide an appropriate real-life context for the findings that emerged concerning the perceptions and experiences of the participants of environmental risk at the mine. The locations of the operations of the mine and the local community are illustrated in Figure 3.5. Direct observations of the mineworkers at work enabled the researcher to obtain a realistic understanding of both the prevailing social conditions and the working conditions in which they functioned at the mine, for the ultimate purpose of generating a thick description of the daily working lives of the mineworkers (Bailey, 2007).

Figure 3.5: *Mining activities observed by the researcher that could contribute to environmental risk at the Walvis Bay Salt Holdings mine (Author, 2019)*

Although Hancock, Windridge, and Ockleford (2009) maintain that observations can be used by researchers when it is not possible to obtain data through other means, in this study they were used to verify information that was provided in the face-to-face interviews and focus group discussions. The researcher was motivated to make close and detailed observations of the mineworkers in their working environment by the almost symbiotic relationships that often exist between miners and the mines in which they work. The researcher prioritised the following observations:

- The construction of tunnels at the mine and the safety measures that had been implemented.
- The uniforms that were issued to the mineworkers and their living conditions, in order to assess their general morale.

As it will be seen in the following chapter, the data that the researcher collected through observations made a significant contribution to answering the research questions that were formulated to articulate the aims and objectives of the study.

3.6.2 Sources of secondary data

The researcher reviewed and analysed several relevant documents to obtain secondary data. Williams (2007) describes secondary research as a widely used means of obtaining supplementary supporting data. Secondary sources of data included archival documents, such as risk assessment reports and published documents from government archives, and peer-reviewed academic publications, maps, textbooks, and relevant journals. This

component of the research provided the researcher with as objective a yardstick as it was possible to obtain for assessing the subjective perceptions of the mineworkers of the environmental risk that resulted from the operations of the mine, in the interests of answering the research questions in an appropriately comprehensive manner.

3.6.2.1 Document analysis

Document analysis took the form of conducting a comprehensive review of mining policy documents and health and safety policies at the WBSH mine, which enabled the researcher to develop an understanding of the priority that was accorded to considerations pertaining to environmental risk at the mine. Performing the document analysis also allowed the researcher to compare the findings that it generated with the data that was obtained from the qualitative and quantitative studies. Other documents that were reviewed and analysed included mission statements of the mining company, general codes of conduct to which mineworkers were expected to adhere, annual reports, human resources policy documents pertaining to the contracts of mineworkers, logbooks, policy circulars, and minutes of meetings that were held at the mine (Flick, Von Kardoff, & Steinke, 2004; Hancock et al., 2009). This component of the study not only afforded crucial insights into the considerations that the management took into account to implement appropriate measures to contain and minimise environmental risk, but it also increased the overall understanding of the researcher of the nature of environmental risk and enabled her to identify considerations that do not appear to have been sufficiently adequately covered in the relevant available literature to date and to supplement the data that had been obtained through the use of other research methods.

Table 3.2: *Interview schedule*

Company*	Department**	Participant***	Interviews	
			Date: Mar- 2019- June -2019	Time
* WBSH	Engineering	***MMW_1; **GMW_2; ***MMW_3; **GMW_4 **GMW_5; **GMW_8	(i) 3 Mar; (ii) 12 April; (iii) 18 April; (iv) 19 April	(i) 10-11am; (ii) 12-1pm; (iii) 11-11:45am; (iv) 10-10:45am
	Environment	**GMW_9; **GMW_25; ***MMW_11; **GMW_12 **GMW_13; **GMW_34	(v) 30 May; (vi) 12 May; (vii) 13 May; (viii) 22 May	(xx) 10-11am; (xii) 12-1pm; (xvi) 11-11:45am; (xxi) 10-10:45am
	Health & Safety	**GMW_20; **GMW_21; **GMW_15; **GMW_16 **GMW_19; GMW_24	(xi) 25 Jun; (xii) 28 Jun	(a) 10-11am; (b) 12-1pm;

**Walvis Bay Salt Holdings Mine (WBSH)*
***General Mine Worker (GMW)*

****Management Mine Worker (MMW)*

3.7 Methods and techniques employed to analyse the data

The sets of quantitative and qualitative data that the mixed methods study generated were analysed concurrently (Caracelli & Greene, 1993; Creswell & Plano Clark, 2007; Tashakkori & Teddlie, 1998). The qualitative data from the interviews and focus group discussions was analysed by means of thematic analysis, while the quantitative data was subjected to sequential analysis (Neuman, 2011). This procedure enabled the researcher to gain a continuously deepening understanding of the research topic as the analyses of the two sets of data proceeded (Masuku, 2011).

Thematic analysis was chosen as an optimal means of analysing the qualitative data to enable the researcher to answer the research questions that were articulated in section 3.1 as comprehensively as possible. As Braun and Clarke (2006) explain, thematic analysis entails discerning and recording the patterns or themes that emerge from following a sequence of analytical steps. From a not unrelated standpoint, Boyatzis, (1998) explains that the methods of thematic analysis enable researchers to identify and record the patterns that are found in data and to discern relationships between emerging themes.

The data that the interviews and focus group discussions generated was also analysed by means of Excel spreadsheets, to develop bar and pie charts to depict the distributions of the responses of the participants. The charts made it possible to compare the ratios of differences and similarities, which, in parallel with the emerging themes from the thematic analysis, made it possible to increase the degree of precision with which the implications of each emerging theme could be analysed. The researcher identified and recorded both the common underlying themes that began to emerge from the qualitative data and also the differences that were evident among the perceptions of the participants from their responses in the interviews and their contributions to the focus group discussions. Braun and Clarke (2006) prescribe six steps for carrying out a thematic analysis, which they maintain are inflexible rules for progressively facilitating the emergence of discernible themes from qualitative data.

3.7.1 Thematic analysis

The procedures that the researcher followed to perform the thematic analysis in accordance with the steps that Braun and Clark (2006) prescribe are summarised as follows:

- **Become familiar with the data:** The researcher collected all of the qualitative data together, including the notes that she had made to record direct observations. She carefully read through all of the information several times, in order to digest it, and

recorded her initial impressions of the possible significance of details that appeared to be particularly striking.

- **Generate initial codes:** In this step the researcher assigned codes to each fragment of data that appeared to be relevant to any of the research questions. Although there were more codes than the themes that were eventually identified, they nonetheless cohered to provide an initial rough sketch of the forms that the themes were likely to take.
- **Search for themes:** This step entailed grouping together coded pieces of data that appeared to suggest possible themes pertaining to the research questions. The researcher accomplished this step by organising and sorting relevant extracts of data, before combining or splitting them according to the overarching themes to which they appeared to belong, while at the same time carefully noting the relationships that were evident among the codes, themes, and sub-themes.
- **Review themes:** The in-depth reviewing of the themes required the researcher to make decisions concerning whether to combine, divide, or discard any of the themes that had been identified in the previous step. The themes were reviewed and evaluated according to two complementary criteria, namely, that the codes that were combined to form them should cohere in a meaningful manner and individual themes should be clearly distinct from one another. This step is often accomplished by conducting an appraisal of each theme in relation to the coded extracts and then doing so against a complete set of data.
- **Define and name themes:** This step required the researcher to refine the themes still further, through continuous analysis, and to identify any subthemes that they might generate, before assigning appropriate names to them and concise descriptions of their exact import. At this point it is essential that a coherent account of the phenomenon that is being investigated should emerge.
- **Write the report:** The final step entailed transforming the analysis into a readable and compelling account that successfully aligned the findings that emerged from the analysis with the research questions that had guided the conducting of the study and the literature that had been consulted to give the study a credible orientation in the field of research in the social sciences. It is essential that the report should serve to convince that the analysis is valid and demonstrate that it is supported by empirical evidence that is relevant to the research questions.

3.7.2 Analysis of the data generated by the Likert scale section of the questionnaire

Analysis of the quantitative data that the Likert scale section of the questionnaire generated commenced with the researcher assigning numerical codes by means of version 26 of the Statistical Package for the Social Sciences (SPSS) software, with the assistance of a statistician who was employed by the Cape Peninsula University of Technology. A code of 0 was assigned to negative responses, while positive responses were assigned a code of 1. Codes from 2 to 5 were used to attribute other meanings to the data. It needs to be emphasised that the coding of qualitative data differs greatly from that of quantitative data, as in the latter case raw data is converted into numerical representations, to allow statistical analyses to be performed on the aggregated data (Welman & Kruger, 2001). Welman and Kruger (2001) explain that assigning numerical codes helps researchers to analyse their quantitative data in a manner that increases its validity and credibility. The quantitative data is presented in the forms of graphs, charts, and tables in the following chapter.

3.8 Verification and trustworthiness of the qualitative data

The researcher applied the four criteria that Guba and Lincoln (1988) introduced to mirror the criteria of validity and reliability that are usually applied to quantitative data, namely, credibility, dependability, transferability, and confirmability, to determine trustworthiness of the findings that emerged from the thematic analysis. Evaluating the quality of data that is collected in a research undertaking is a necessary means of ensuring that questions surrounding internal and external validity or representativeness, reliability, and objectivity are satisfactorily answered. In this type of research study, the four criteria of dependability, transferability, credibility, and confirmability accurately reflect the assumptions of the qualitative paradigm (Guba & Lincoln, 1988, De Vos et al., 2011), as it is widely acknowledged in the field of qualitative research that the criteria are sufficiently trustworthy to ensure the rigour of qualitative findings (Guba & Lincoln, 1981; Schwandt, Lincoln, & Guba, 2007; Miles, Huberman, & Saldaña, 2013).

3.8.1 Credibility or authenticity of data

Credibility is the criterion that is applied to determine whether an inquiry has accurately investigated a particular event, occurrence, or phenomenon (Schurink, Fouché, & De Vos, 2011), and that it has evaluated what it had been intended to evaluate (Shenton, 2004). This criterion ensures that a study has been conducted within the parameters that the research design had set and that the researcher had made sufficiently effective use of the research

instruments that had been developed to collect and analyse the data to enable the research questions to be answered and the objectives of the research to be achieved. Onwuegbuzie and Leech (2007: 109) hold that increasing credibility of qualitative research requires prolonged engagement with the participants, continuous observation, triangulating the findings that have been obtained through the use of different research methods, peer debriefing and member checks, and the rigorous application of formalised qualitative methods such as grounded analytic induction. The researcher duly endeavoured to satisfy each of these requirements.

She made extensive use of field notes to provide contextual cues for evaluating data and preserved all of the raw data that the interviews and focus group discussions generated by means of audio recordings, to enable her to re-acquaint herself with the original data after she had reflected on it. In addition, the steps that Braun and Clark (2006) prescribe for performing of a thematic analysis were adhered to scrupulously, to ensure the credibility of the findings that the analysis yielded. One of the cornerstones of the credibility of the findings of this study is the continuous and active engagement of the researcher with the participants in their own environment over a prolonged period of time, which Leedy and Ormrod (2010) hold to be a crucial means of increasing the credibility and dependability of the findings of research studies. Continuous observations of participants in their accustomed environment also helps to engender meaningful relationships and trust between researchers and the participants in their studies (Babbie & Mouton, 2001; Polit & Beck, 2010).

3.8.2 Transferability of data

Transferability is the extent to which a finding or set of findings from a study can be transferred to another context (Schurink, Fouché, & De Vos, 2011). It places the responsibility on the researcher for ensuring that sufficient contextual information is provided to enable anyone who reads the study to decide if the event, occurrence, or phenomenon that is investigated in it is similar to the one to which the findings are to be transferred (Shenton, 2004). Conversely, Krefting (1991) holds that confirmability is the degree to which the findings of a study result from the nature of the research topic, rather than the biases of the researcher or researchers who conducted the study. In addition, it refers to the extent to which the findings of an investigation can be independently validated or supported by other researchers (Walker & Baxter, 2019).

3.9 Management of the quality of research

3.9.1 Limitations of the research and how they were minimised

One of the most obvious limitations of the study stems from the decision of the researcher to conduct a case study, which restricted her ability to generalise the findings to other similar conditions or contexts. Another potential limitation of case studies is the possibility of findings being influenced by subjective factors, which the researcher took care to circumvent by adopting a mixed-methods research design and corroborating the sets of data that the qualitative and quantitative studies generated through triangulation (Neuendorf, 2016). Although she made use of several different sources of data, the coding of the data, the findings of the study, and the conclusions that were drawn from them, were generated from a single perspective, namely, that of the researcher.

3.9.2 Ethical considerations and informed consent

During the primary stages of the planning of this research study, the supervisor of the researcher drafted and sent a letter to the human resources department of Walvis Bay Salt Holdings (Pty) Ltd, in which he requested permission to conduct the study at the mine. The letter appears in the appendices as Appendix D. In addition, it was necessary to obtain ethical clearance to conduct the study, in the form of an ethical clearance certificate, from the Faculty Research Ethics Committee (FREC) of CPUT, which appears as Appendix F in the appendices.

To comply with the standards of ethical conduct that apply to all research in the social sciences, it was necessary for the researcher to take all reasonable measures to ensure that the rights of the participants were scrupulously respected and upheld throughout the conducting of the study (Creswell, 2009). In the case of the questionnaire, prospective respondents indicated verbally whether or not they wished to participate in the study, after its purpose and objectives had been explained to them. By contrast, the participants in the qualitative study were required to sign a form in which they acknowledged that they were aware of the nature and purpose of the study, that their participation was strictly voluntary, and that they understood that they would be within their rights to withdraw from participating at any time, without incurring penalties of any sort whatsoever.

3.9.3 Anonymity and confidentiality

The anonymity of participants and the confidentiality with which the information that they volunteered is treated are central to all ethical research practices in the social sciences

(Bhatterchergee, 2012). Accordingly, the participants are identified by numbers only in the transcripts that are cited in the discussions of the qualitative data and no one other than the researcher and her research team had access to any of the data that the information that they supplied generated. The interviewees and participants in the focus group discussions were also assured that the information that they provided and their personal details would remain confidential and that the research was purely for academic purposes.

3.10 Conclusion

This chapter represents an attempt to provide a coherent and comprehensive account of the development of the research methodology that was used to conduct this study, which was informed by the sequential development that is illustrated in the research onion of Saunders et al. (2007). The progressive peeling of the layers of the onion provided a logical step-by-step plan for developing the research methodology that moved from its beginnings in a specific philosophical orientation, to the adoption of an approach that determined the choices of a suitable research design, and ultimately to the practical domain of the methods that would be used to collect and analyse the data.

One of the principal benefits of adopting the onion was the consistent basis that it provided for making an appropriate choice at each stage of the development of the methodology. The strategies that were adopted to manage the inherent limitations of the study have been covered, as have the measures that the researcher took to ensure that the ethical standards that apply to all professional research in the social sciences were observed and maintained at all times during the conducting of the study. The following chapter takes the form of a detailed and in-depth presentation of the findings of the study.

CHAPTER 4: PRESENTATION OF THE FINDINGS

4.1 Introduction

This chapter is devoted to a presentation of the findings of the qualitative and quantitative components of this study, which are discussed and analysed in the following chapter. De Vos et al. (2011) explain that the analysis of data essentially entails conferring order, structure, and meaning on a mass of collected data. The principal purpose of this chapter is to present the findings in a coherent and ordered form, to facilitate a detailed analysis.

4.2 PRESENTATION OF THE QUANTITATIVE FINDINGS

4.2.1 Demographic characteristics of the mineworkers

The SPSS software enabled the quantitative demographic data of the mineworkers who responded to the questionnaire to be presented in the forms of frequency tables and descriptive statistics. During the extrapolation of the data, the researcher used means, standard deviations, and frequencies to generate demographic data that provided an appropriate context for the perceptions of mineworkers of environmental risk at the mine, which were reflected by their responses to the statements that required ratings according to a Likert scale.

As it can be seen in the tables in this chapter, gender did not appear to exert a significant influence on the perceptions of the respondents of environmental risk at the WBSH mine. Although all were Namibian citizens, a significant portion had come to Walvis Bay from other parts of the country. While a majority of 58% were from Walvis Bay, the remaining 42% comprised 28% of the research sample who were from Swakopmund, a further 6% from Langstrand, and 8% from Windhoek.

The findings also revealed that a majority of 55% of the respondents perceived that salt mining posed risks to their general health and safety and was inherently hazardous, while the remaining 45% appeared to believe that wearing protective clothing and safety equipment provided the only safe means of reducing exposure to hazards, risk, and potentially harmful materials. The perceptions of the respondents were interpreted from their ratings of from 1 to 5 on the Likert scale, to indicate the extents to which they either agreed or disagreed with each statement. A rating of 1 indicated strong disagreement, 2 disagreement, 3 a neutral response, 4 agreement, and 5 strong agreement.

Table 4.1: *Frequency distribution table of demographic characteristics of the respondents*

Demographic characteristics of the respondents: Levels of educational attainment, gender, and age

Variable	Frequency (n=40)	Percentage (%=100)
Level of education attained		
Basic education	7	17.5
Secondary education	6	15
Tertiary education	27	67.5
Gender		
Female	11	27.5
Male	29	72.5
Age (Years)		
18-25	5	12.5
26-30	10	37.5
31-35	13	32.5
41-45	10	25
46+	2	5

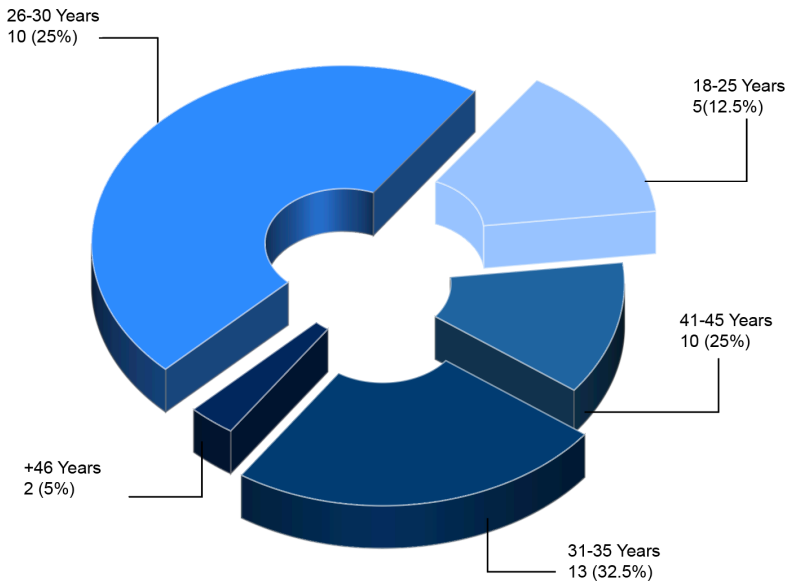


Figure 4.1: *Frequency distribution chart of the ages of the respondents (Author, 2020)*

The demographic data in Table 4.1 provides the background information that is needed to develop an informed understanding of the perceptions of mineworkers of environmental risk at the mine in relation to their socioeconomic status. A majority of 32.5% of the respondents were from 31 to 35 years of age. The second largest group comprised those who were from 26 to 30 years old, who accounted for 25% of the sample. A further 25% fell into the age group of from 41 to 45 years, while 12.5% were from 18 to 25 years of age, and a very small minority of 5% were 46 years old or older.

These findings suggest that the majority of the population of mineworkers at the WBSH mine are still in their prime years. Of equal significance was that 81.8% of the sample who were

more than 20 years old had received tertiary education, while those in the same age bracket whose formal education had ended either when they matriculated or while they were at secondary school amounted to only 9.1%. If these findings could be generalised to the workforce of miners at the WBSH mine as a whole, they would indicate that it comprised more young graduates than workers who held only matriculation or basic education certificates. They are also indicative of a lack of opportunities for graduates in the formal employment sector, as it could reasonably be concluded that graduates seek employment on mines as a means of staving off unemployment while they wait for opportunities to make full use of their qualifications. There were several other significant demographic characteristics. The average number of dependants of the 40 mineworkers in the research sample was 4.2 persons per family household. In addition, 57.7% of the respondents were the sole breadwinners in their households. Those who could afford their own medical care amounted to 51.7%, while 87.1% were affiliated to a mining union. These figures provide a clear indication that a significant number of mineworkers at the WBSH mine lacked the resources to afford private healthcare and welfare services.

4.2.2 Measures taken to monitor the health of mineworkers and perceptions of the respondents of the risks to which their work exposed them

As it can be seen in Table 4.2, more than half of the respondents expressed satisfaction with the measures that the management of the mine took to ensure that their health was adequately monitored, while the remainder either expressed dissatisfaction or preferred not to respond. While the possibility of contracting lung cancer or skin cancer as a consequence of exposure to occupational hazards were the most cited health-related concerns, all of the other ailments that were listed elicited responses.

Table 4.2: *Frequency distribution table of satisfaction of the respondents with available healthcare services and the occupational hazards that concerned them most*

Health-related concerns

Variable	Frequency (n=40)	Percentage (%=100)
Does your employer take you to the hospital for regular medical check-ups?		
Satisfied	13	32.5
Very satisfied	10	25
Not satisfied	9	22.5
Prefer not to say	8	20
Which occupational hazards to your health and safety concern you most?		
Severe respiratory disease	3	7.5

Lung cancer	11	27.5
Skin cancer	9	22.5
Pneumonia	8	20
Thermal stress	6	15
Musculoskeletal disorders	3	7.5

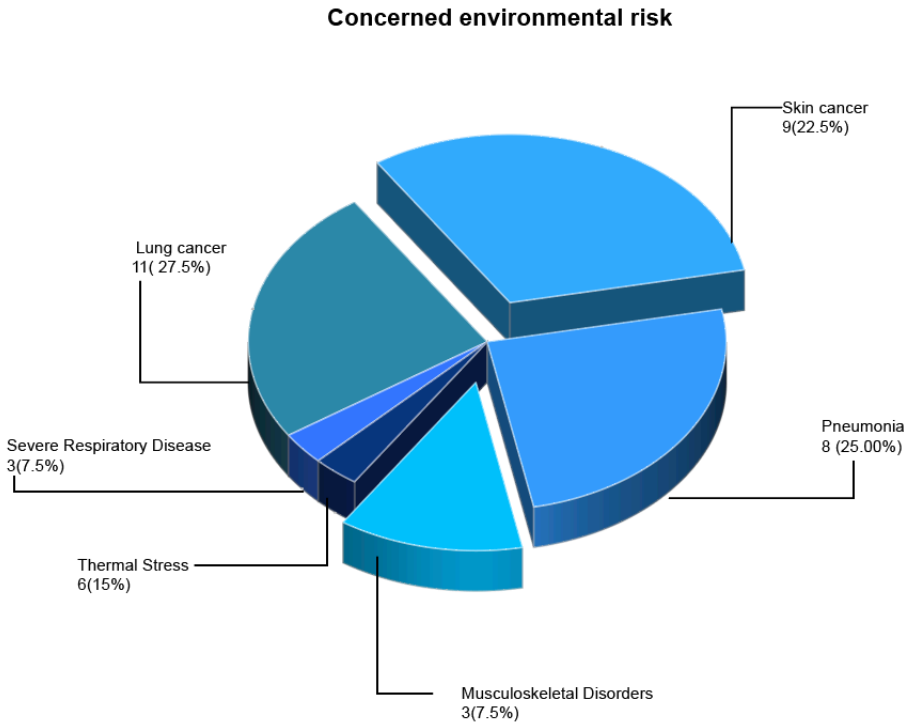


Figure 4.2: *Health-related concerns of the respondents (Author, 2020)*

4.2.3 Lengths of time for which the respondents had worked at the WBSH mine

The lengths of time for which both mineworkers and members of the management have worked at the WBSH mine provide an indication of the degree of stability that they are likely to perceive that their employment at the mine confers. As it can be seen in Table 4.3, the distribution of durations was skewed slightly in favour of the respondents who had worked at the mine for more than 2 years, who accounted for 52.5% of the research sample. This finding could suggest that mineworkers who have worked at the mine for a number of years constitute a relatively immobile group whose ability to secure more lucrative employment elsewhere tends to be impeded by their economic circumstances, which are generally compounded by the immediate needs of several dependants.

Table 4.3: *Frequency distribution table of the lengths of time for which the respondents had worked at the WBSH mine*

Durations of employment

Variable	Frequency (n=40)	Percentage (%=100)
Durations of time for which the respondents had worked at the WBSH mine		
0-3 months	2	5
4-6 months	5	12.5
7-9 months	5	12.5
10-12 months	3	7.5
13-24 months	4	10
25-36 months	6	15
37-48 months	8	20
48+ months	7	17.5

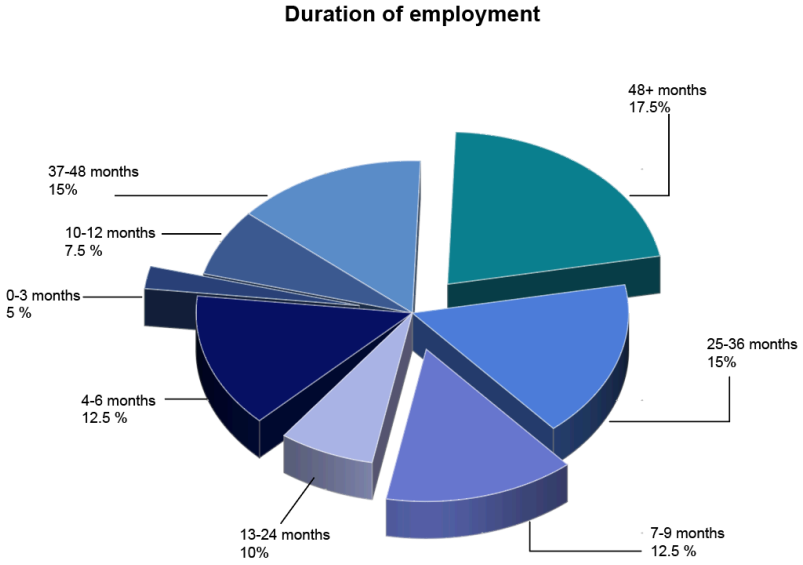


Figure 4.3: *Lengths of time for which the respondents had worked at the WBSH mine*

To obtain an accurate understanding of the prevalence of risk events at the WBSH mine and the extent to which mineworkers are exposed to them, it is necessary to appreciate the degrees to which the lengths of time for which individual workers have worked at the mine determine both the risk events to which they are most frequently exposed and their perceptions of them.

4.2.4 Provision and use of personal protective equipment (PPE)

The findings that are summarised in Table 4.4 reflect the percentages of the respondents who had been issued with gloves, respirator masks, safety boots, safety overalls, and goggles. Although the criteria that determined which mineworkers were issued with personal protective equipment were the duties that they performed and the level of risk that their work entailed

owing to exposure to dangerous chemicals and substances, it was evident from direct observations that some workers did not appear to have adequate clothing or equipment to protect themselves. It was also evident that preference appeared to be given to long-term mineworkers who were on the permanent staff and had several years of experience of working at the mine.

Table 4.4: *Frequency distribution table of the provision and use of personal protective equipment (PPE)*

Provision and use of protective equipment

Variable	Frequency (n=40)	Percentage (%=100)
Which types of personal protective equipment (PPE) are provided to you as an employee?		
Gloves	1	2.5
Respirator masks	9	22.5
Safety boots	15	37.5
Safety overalls	11	27.5
Goggles	4	10

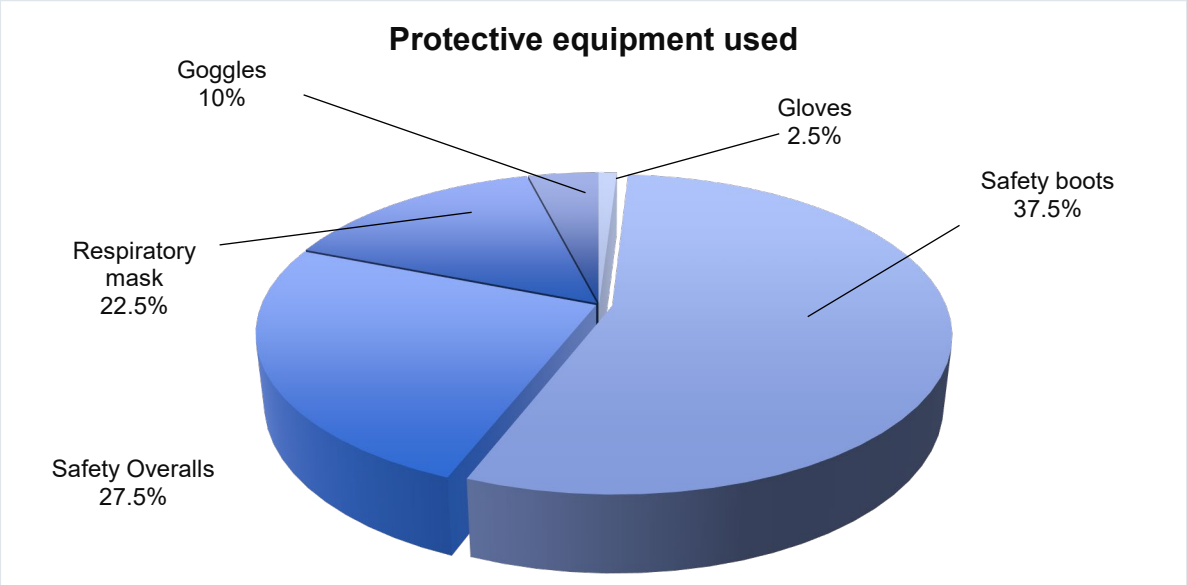


Figure 4.4: *Distribution chart of recipients of personal protective equipment (PPE) (Author, 2020)*

Table 4.5: *Frequency distribution table of the relationship between the provision of personal protective equipment (PPE) and the duties that the respondents performed at the mine*

Relationship between tasks performed by the respondents and allocation of PPE

Variable	Frequency (n=40)	Percentage (%=100)
What are your daily duties?		
Mining refined salt	20	50

Mining coarse salt	11	27.5
Packaging salt	8	20
Cleaning mining equipment	1	2.5
What types of safety equipment are issued to you to protect you from hazards to your health?		
Gloves	1	2.5
Respirator masks	7	17.5
Safety boots	15	37.5
Safety overalls	13	32.5

The findings that are summarised in Table 4.5 reflect trends in the provision of personal protective equipment and clothing and the types of work that the respondents performed and the degree of risk to which they were likely to be exposed. As it can be seen in the table, the work of a majority of 50% of the respondents entailed the refining of salt, in which salt that has been extracted from sea water is treated with chemicals to make it suitable for a number of different uses. The second largest group of 27.5% of the research sample worked in the mining of coarse salt, while 20% were employed to package salt and a tiny minority of 2.5%, which corresponded with the number of respondents who were issued with safety gloves, were employed to clean mining equipment.

Although the largest percentages of respondents, 37.5% and 32.5% respectively, had been issued with safety boots and overalls, neither of these percentages corresponded with the numbers of respondents who worked in the mining of raw salt or the refining of salt that had been extracted from sea water. The inevitable provisional conclusion from these findings is that insufficient numbers of the respondents to the questionnaire had been adequately equipped with personal protective clothing and equipment to protect them from the hazards that their working environment posed to their health, safety, and well-being.

4.2.4 Trade unions to which the respondents were affiliated

In order to broaden the profile of the respondents to the questionnaire, it was necessary to determine their political affiliations. The findings that are depicted in the frequency distribution bar graph in Figure 4.5 are indicative of political differences between members of the management and general mineworkers, as for the latter, trade unions represent the only effective means of voicing their grievances. As the Mineworkers Union of Namibia (MUN) is one of the most powerful unions in Namibia and has played a visible and active role in coordinating general strikes at the WBSH mine, the finding that it enjoyed the greater affiliation among the respondents to the questionnaire was an unsurprising one, although significant numbers were affiliated to the National Union of Namibian Workers (NUNW). In several cases,

the respondents were affiliated to both unions. Of the male respondents, 78.6% were affiliated to the MUN and 60.7% to the NUNW, while 75% of the female respondents were affiliated to the MUN and 50% to the NUNW. The findings are also indicative of the collective desire of the mineworkers at the WBSH mine to play an active role in the making of decisions that affect their interests, health, and overall well-being. It was also evident, from talking to mineworkers at the mine, that many feared dismissals if they were not affiliated to unions whose membership was sufficiently large to campaign forcefully for increased wages and improved working conditions.

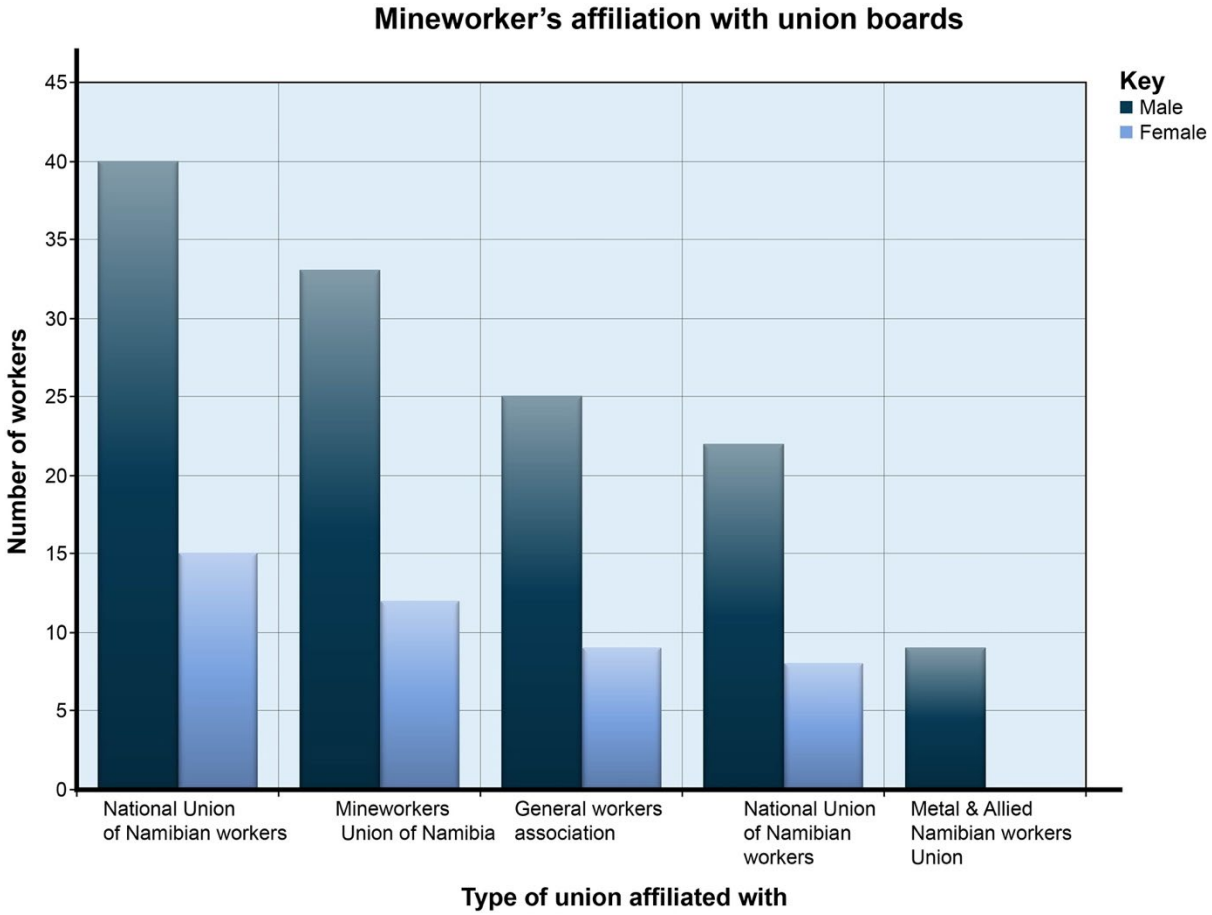


Figure 4.5: *Frequency distribution bar graph of the trade unions to which the respondents were affiliated (Author,2020)*

The willingness of the mineworkers to pay monthly subscription fees to their unions also demonstrates their commitment to being adequately represented in decision making. Although several general mineworkers expressed a desire to the researcher for mineworkers and members of the management to be afforded a single vote each, others believed that group representation would be acceptable.

4.3 Mining activities at the WBSH mine

4.3.1 Operations that are carried out at the WBSH mine

Operations at the Walvis Bay Salt Holdings mine are highly reliant on the intake of seawater that occurs at the northernmost point of the pans that are situated at the southern tip of the outer lagoon, to produce coarse salt. As it can be seen in Table 4.5, a full 50% of the randomly selected research sample who responded to the survey questionnaire worked in the refining of salt, which entails treating the salt with chemicals, some of which are potentially hazardous. The second largest group of 27.5% of the respondents were employed to mine coarse salt, which can also expose workers to a range of different sources of risk.

The researcher was able to determine from direct observation that the production of salt at the WBSH mine mainly occurs in the salt pans and fields that are located in the dune fields of the Namib Desert, which borders the concentration pond to the east, while on the western side of the mine is the Atlantic Ocean (EIA, 2012). Salt is produced from seawater, by means of solar evaporation.

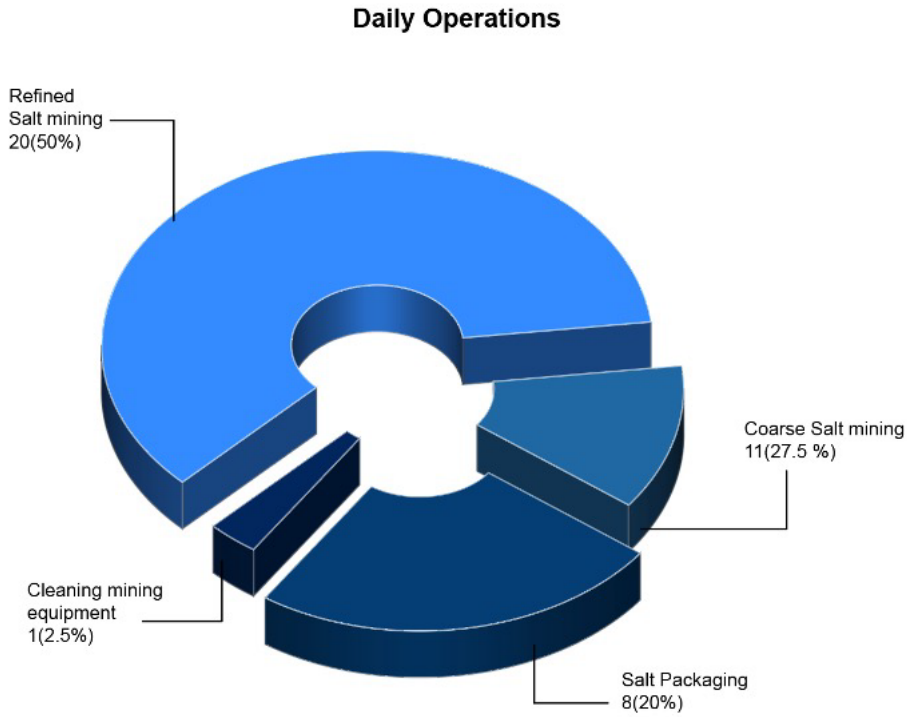


Figure 4.6: *Distribution chart of the duties performed by the respondents at the WBSH mine (Author, 2019)*

The only raw material that is used to produce 99.4% pure sodium chloride (NaCl) in dry mass is seawater. Sodium chloride accounts for 2.7% of the initial concentration of 3.5% of salt in the water, which is pumped from the deeper side of the Walvis Bay Lagoon, a Ramsar site, at

a rate of 240m3 per minute, into a series of pre-evaporation ponds, and then into a series of concentration ponds. The photograph in Figure 4.7 illustrates the sequence that is followed.

Figure 4.7: *Solar evaporation in the production of salt at the WBSH mine (WBSH, 2019)*

As Figure 4.7 illustrates, the crystallisation of salt occurs when seawater is exposed to external agents such as the sun and wind, which accelerates evaporation when seawater enters the drying ponds. Before the seawater is pumped into the drying ponds, it is first treated with chemical agents to produce a brine salinity mixture that consists of concentrated seawater, which is then pumped into crystallisation ponds, where it reaches the point of 25% crystallisation.

The process continues until all of the salt has been harvested from the concentrated brine mixture and is repeated until a certain amount of salt has been harvested from the ponds. The crystallisation ponds are flooded and re-flooded with fresh maiden brine after the magnesium content of the brine has risen by 3%, over a period of roughly 4 months (EIA, 2016). The brine that is drained off is known as bitterns and is discharged with a permit into the Atlantic Ocean, which can be seen in Figure 4.7.

The photograph in Figure 4.8 provides a compelling insight into the potential for workers to be exposed to a wide range of hazards as a consequence of harvesting and washing crystallised salt. Many of the chemicals that are used in the wash area are potentially hazardous and the fine airborne particles of dust and salt that proliferate in the atmosphere stand to compromise their respiratory health severely if they are not provided with adequate protective equipment, such as respirator masks. Consequently, the finding that is reflected in Table 4.5, that although 50% of the respondents worked in the refining of salt and 27.5% in the mining of coarse salt, only 17.5% had been issued with respirator masks, is a particularly disturbing one.

Conversely, the findings in Table 4.5 also suggest that some of the operations entailed considerably less risk than others. The relatively clean conditions in which workers who are employed to package and ship salt and the advanced equipment that is used appear to ensure that their health is not threatened by their work (EIA, 2016).

Figure 4.8: *Harvesting and washing of salt (WBSH, 2019)*

Mineworkers who work in the processing plant ensure that processed salt is dried and kept safe in a centrifuge, where it is stored and prepared for packaging and distribution to other parts of the country and to overseas markets. The researcher observed salt being packaged at the bagging plant, according to the masses that were required by different distributors, prior to being shipped in large containers by sea, air, and road transport, to a number of different destinations on the African continent and throughout the world (EIA, 2012). The photograph in Figure 4.9 depicts the bulk stacking of salt, before it is refined and processed.

Figure 4.9: *Bulk stacking of salt (WBSH, 2019)*

4.3.1.2 The refining of salt and adverse effects on the local ecology

The labour-intensive nature of duties that are associated with the refining of salt necessarily entails large numbers of employees of Walvis Bay Salt Holdings (Pty) Ltd being exposed to severe hazards to their health. Table 4.2 revealed that the largest percentages of the respondents feared succumbing to lung and skin cancer. It was also evident that the operations of the WBSH mine had profoundly changed the ecology of the lagoon area. Although some measures to mitigate harmful consequences for the environment have been introduced, the damage that has been done is clearly discernible. To the south-east of the WBSH complex, shrubs such as salsola and other species of flora are visibly dying, a phenomenon that has been attributed to a combination of water extraction further inland, which has resulted in an influx of saline water from the sea, and salt-producing activities in the adjacent area. Although the threats to the environment and the adverse effects that have resulted from the production of salt in the area are indisputable, it is nonetheless imperative to combine the factual evidence with an appraisal of how environmental risk and the hazards to which people are exposed are perceived by those who are most directly affected by them. Accordingly, the next section is devoted to a presentation and discussion of relevant excerpts of the data that the qualitative study generated.

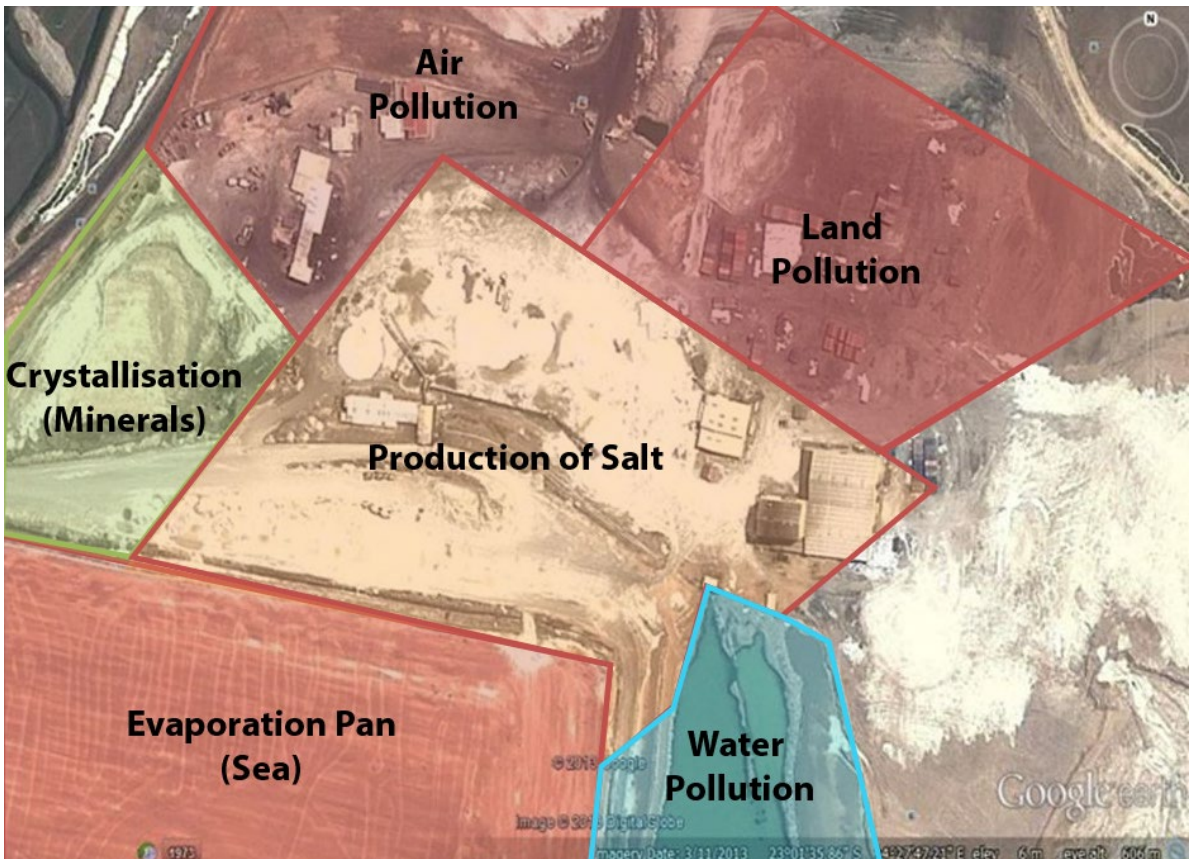


Figure 4.10: *Types of environmental risk posed by the operations of the WBSH mine (WBSH, 2019)*

4.4 PRESENTATION OF THE QUALITATIVE FINDINGS

4.4.1 Environmental risk events at the WBSH mine: Levels of risk reported by members of the management

To obtain a sufficiently detailed understanding of the nature of environmental risk events at the WBSH mine, participants in the interviews and focus group discussions were asked questions concerning the activities on which the operations of the mining company centred. This strategy was adopted to determine whether general mineworkers had been provided with training in the management of environmental risk at the mine. In addition, members of the management of the mine were requested to enumerate the measures that had been implemented in response to environmental concerns that had been raised by general mineworkers. These questions were posed to obtain a multifaceted appraisal of the ways in which environmental risk events and threats to the environment were perceived at the WBSH mine. The data that generated this theme was analysed critically, in relation to levels of soil pollution, waste pollution, noise pollution, and water pollution. The sources of pollution are identified by means of a diagrammatic superimposition on an aerial photograph in Figure 4.10 above.

The principal latent variable of interest, namely, the understanding of mineworkers of the threats that their work posed to the environment and their own health and well-being, was also investigated by means of an analysis of the qualitative data that had been captured on Excel spreadsheets. Figure 4.11 was developed as a representation of the perceptions of the mineworkers of the types of risk to which they and their environment were exposed, within the broader context of their perceptions of themselves, their lives, their socioeconomic status, and their prospects. The findings that emerged from the analysis of the qualitative data that the in-depth interviews generated suggested that perceptions of environmental problems such as water and air pollution were common at the WBSH mine. Some 54% of the mineworkers who were interviewed appeared to believe that conditions at the mine were unsafe and prone to risk. The responses of the interviewees also suggested that many were acutely aware that environmental risk in the form of high levels of pollution had direct and adverse consequences for their general health and well-being, while 46% regarded food and water pollution as the most injurious consequences of environmental risk.

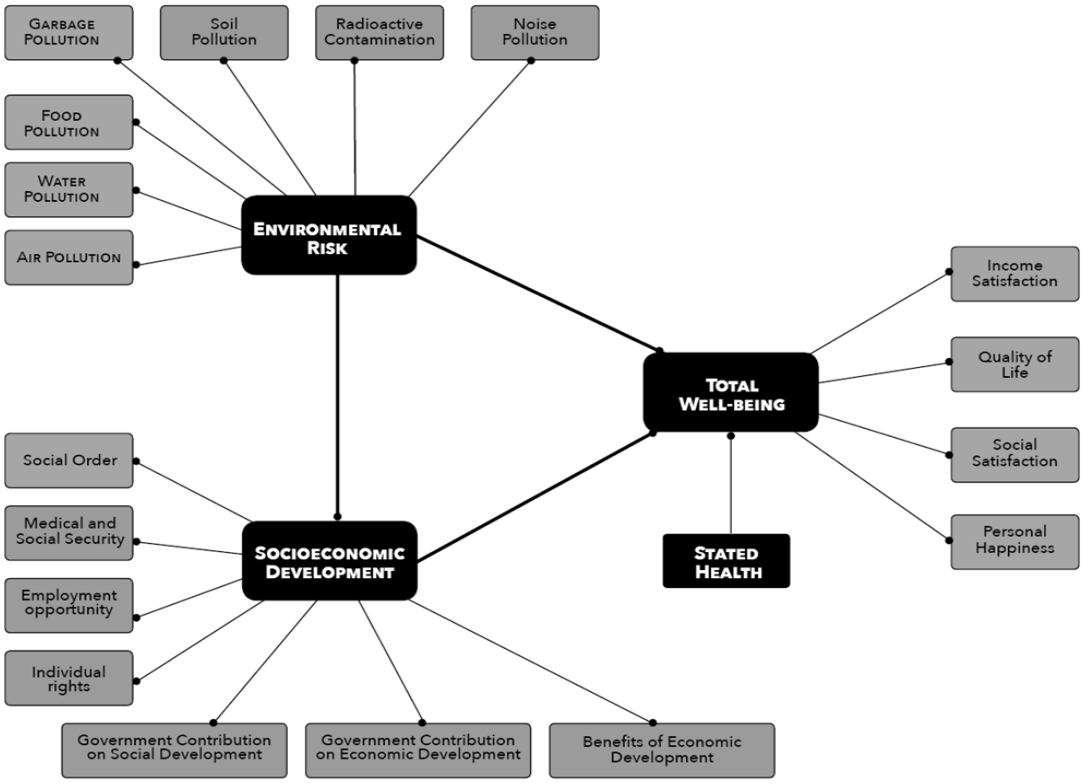


Figure 4.11: *Structure of environmental risk, as adapted from an Atlas.ti qualitative data analysis (QAQDAS), (Author, 2019)*

4.4.2 Working conditions and exposure to risk

The findings that have been presented in the previous sections suggest that their working conditions and the levels of risk to which they were exposed made the most significant contributions to the perceptions of general mineworkers of environmental risk at the WBSH mine. Most of the interviewees complained of air pollution that resulted from salt dust at the mine, while others complained about exposure to harmful materials and chemicals during the refining of salt and expressed concern for their personal safety at work as a direct consequence. In the words of one of the interviewees:

> *"Me, I get exposed to chemicals such as hydrochloric acid and sulphuric acid and inhalation of ammonia, acid burns. Sometimes I am very fearful for my health and being cut by glassware are the most common safety issues on the mine site that I am very concerned about. Maybe this can be changed by giving proper training in using complicated mining equipment to every employee, even if they are casual (contractually employed)."* (Management mineworker 1).

This excerpt confirms that the operations of the mine are perceived to be hazardous by the workers who are exposed to risk. From a different perspective, a member of the management of the mine offered the following appraisal:

> *"The type of chemicals and harmful solutions I have come across here are very dangerous and risky. Sometimes it is very risky to touch these chemicals, but I am safe because I wear my personal protective clothing every day. Apart from that, I believe laboratory workers must be exposed to other activities outside the labs, to minimise regular exposure to chemicals, as this could be very harmful in the long run."* (Manager 1).

This assessment is an implicit acknowledgement by a manager that laboratory workers are exposed to dangerous chemicals that are extremely hazardous to their health and well-being and expresses the belief that they should not be continuously exposed to them. One of the interviewees who worked in the laboratory expressed the same concern in relation to exposure to chemical substances in the following excerpt:

> *"We normally get exposed to harmful materials, from the release of toxic vapours, dust, mists, or gases into the workplace air. Inappropriate personal protective equipment can result in exposure that causes eye, respiratory, or skin ailments or contact with contaminated equipment. Me, I complain a lot about safety issues, whether chemical and health risks, dust inhalation from the plant, but no one listens. Me and my colleagues we are concerned about noise and vibration. This could be changed by providing intensive training to every employee every week, and not only permanent employees."* (General worker 9)

In his assessment, the company was not doing enough to provide personal protective equipment (PPE) to protect workers from the risks that the types of work that they did at the mine entailed. The excerpt also expresses the degree of frustration that he has endured in his efforts to maintain a healthy and safe working environment, despite the hazards that resulted from the condition of the equipment that he was required to use. Another interviewee complained about the hazards that he encountered as a consequence of working with machinery:

> *"I had a grader injury, debris from the grader getting into your eyes, and when lifting heavy equipment, such as cranes, your hand can get injured and these were the causes of injury and safety problems. I also want to suggest that machines should be attended to by the mechanics, not the operators, due to a lack of expertise and knowledge, and this needs to be changed in the mine."* (General worker 13).

The excerpt from the response of general worker 13 reflects common perceptions among the mineworkers who were interviewed, as they tended to hold that inexpertly maintained equipment and a lack of adequate protective clothing and equipment exposed them to high levels of risk, in the forms of hazards to their general health and unsafe working conditions. Although it could not be recorded as a finding, as it represents a subjectively formed opinion of the researcher, the low socioeconomic status of workers appears to be frequently accompanied by hazardous general working conditions in many instances, owing to a lack of

bargaining power. These findings can be compared directly with those that the quantitative study generated, which are summarised in Table 4.6 and depicted graphically in the frequency distribution chart in Figure 4.12.

Table 4.6: *Frequency distribution table of the perceptions of the respondents to the questionnaire of the principal sources of hazards to their health and safety at the WBSH mine*

Sources of hazards to health and safety at the WBSH mine Variable	Frequency (n=40)	Percentage (%=100)
Perceived sources of hazards at the WBSH mine		
Toxic vapours and gases	8	20
Fire	9	22.5
Chemicals	15	37.5
Contaminated air	8	20

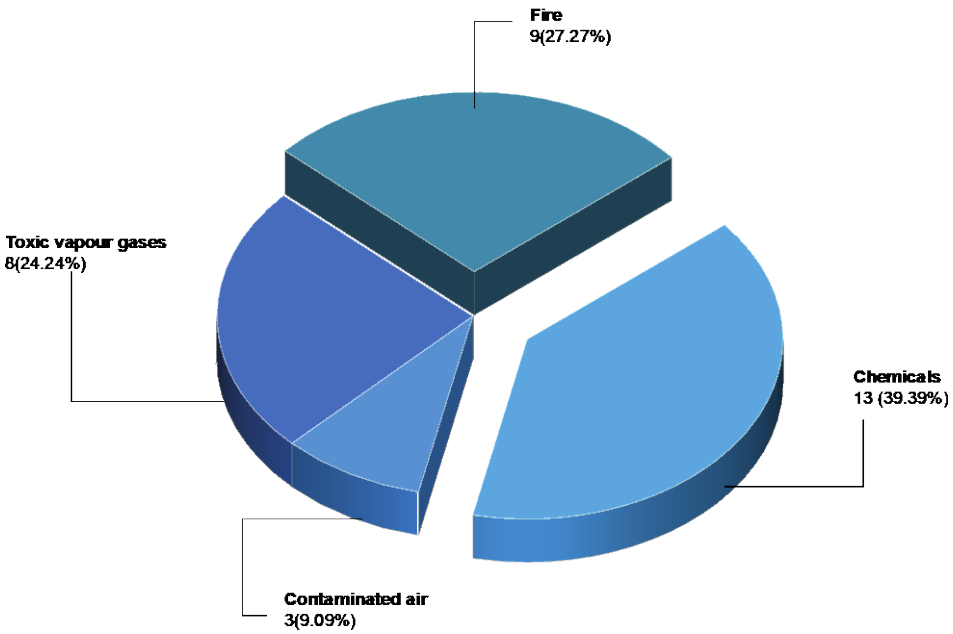


Figure 4.12: *Frequency distribution chart of perceived sources of hazards at the WBSH mine*

As the researcher found strong correlations between the findings that are recorded in Table 4.6 and the types of duties that the interviewees performed and the levels of risk that are associated with each, direct observations of the performing of duties enabled her to conclude that the perceptions of the interviewees of the levels of risk to which they were exposed were accurate and justified.

4.5 Levels of dissatisfaction among mineworkers reflected by the findings

It was abundantly evident to the researcher that a lack of opportunities to secure more lucrative employment elsewhere left the mineworkers with little choice but to find employment at the WBSH mine, despite the hazards that doing so posed to their health and safety and irrespective of their educational qualifications. The perceptions that are reflected in the frequency distribution chart in Figure 4.12 are indicative of the dissatisfaction of the interviewees with their present working conditions. Throughout the collecting of the data, the researcher was able to discern intense irritation at the slightest provocation among many of the miners, which tended to underscore their generally negative perceptions of the company. It would be reasonable to conclude that widespread dissatisfaction is likely to be accompanied by generally poor performance in the carrying out of duties. The findings also suggest that perceptions of working conditions were highly likely to influence the general perceptions of mineworkers of the levels of risk to which they are exposed at the WBSH mine. The data that was collected suggests that substantially increased priority should be accorded to improving the working conditions of mineworkers at the WBSH mine, in order to ensure their overall well-being through the implementation of appropriate health and safety regulations.

4.5.1 Degrees to which the interviewees expressed concern in relation to safety and health at the WBSH mine

Although many of the interviewees expressed deep concern about their safety and health at the WBSH mine, their perceptions tended to be influenced by factors such as working experience, socioeconomic backgrounds, and levels of educational attainment. The analysis of the quantitative study revealed that these three factors exerted a direct influence on the perceptions of the respondents to the questionnaire of safety and health at the mine. The data that the interviews generated added substance to the findings that are summarised in Table 4.7 and depicted in the bar graph in Figure 4.13, by revealing that the most injurious forms of risk as a consequence of exposure to dangerous chemicals were perceived to result from daily exposure to chemicals such as hydrochloric and sulphuric acid, which caused acid burns and contributed to severe respiratory ailments. The inhalation of ammonia was also cited as a severe hazard to health and well-being.

Table 4.7: *Frequency distribution table of the levels of concern that the respondents to the survey questionnaire expressed concerning hazards to health and inadequate safety measures at the WBSH mine*

Degrees of concern expressed by the respondents in relation to safety and health

Variable	Frequency (n=40)	Percentage (%=100)
Degree of concern		

Concerned	7	17.5
Very concerned	18	45
Not concerned	10	25
Prefer not to say	4	10
Not sure	1	2.5

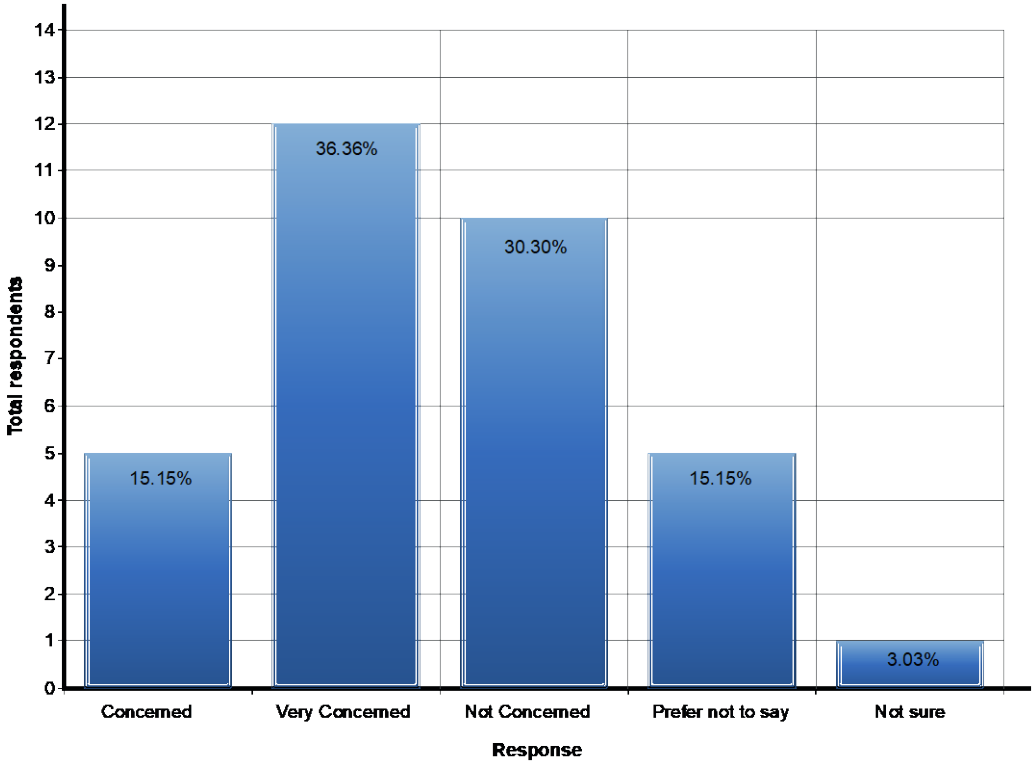


Figure 4.13: *Frequency distribution bar graph of the degrees of concern expressed by the respondents to the survey questionnaire in relation to health and safety at the WBSH mine (Author, 2020)*

The effects of exposure to salt dust in the atmosphere were quite apparent to the researcher, as she noticed that severe bouts of coughing and sneezing were frequent among the mineworkers who were not wearing respirators to protect themselves from inhaling the dust. The contact that the mineworkers had with chemicals took a number of different forms. One of the interviewees described his duties as follows:

> … *"Preparation of all standard solutions that are needed, to analyse moisture in daily samples from washed and unwashed salt, to determine the amount of iodine in samples of salt containing iodates, to determine insoluble matter in raw and washed salt, to determine the amount of calcium and magnesium in raw washed salt."*
> (General mineworker 32).

When one of the interviewees was asked to describe what he feared most in his daily duties at work, he responded as follows:

… *"it is mostly acid spillage"* (Management mine worker 7).

From his response, it was evident that the potential hazards of his work required the wearing of protective clothing and the use of personal protective equipment such as safety googles and gloves. It was equally evident that the socioeconomic status and low level of educational attainment of this interviewee played a significant role in precluding him from understanding the need to wear protective clothing to prevent injury at work. The implications of this finding emphasise the need for making mineworkers aware of the degree of risk to which their work exposes them through education, training, and inspections to ensure that adequate protective clothing and equipment for each of the operations of the mine are used.

4.5.2 Perceptions of working and living conditions at the WBSH mine

The perceptions of the interviewees of their living conditions included perceptions of the standards of living that they were able to enjoy. As general mineworkers tended to rate the acceptability of their living conditions in accordance with their own experiences and expectations, which were significantly different from those of members of the management of the mine, their perceptions of risk also tended to exhibit similar degrees of difference. It is of the greatest significance to note, in this context, that many of the mineworkers who were interviewed expressed the belief that people who lived in informal settlements should find their living conditions acceptable, because they had chosen to live in them.

As it can be seen in the findings from the quantitative study that are summarised in Table 4.8 and depicted graphically in the frequency distribution pyramid in Figure 4.14, the qualitative findings appear to be significantly at variance with those of the quantitative study with respect to the hazards that have been discussed, as 80% of the respondents to the questionnaire expressed satisfaction with the general working conditions at the mine. The perceptions of mineworkers would also inevitably have been broadly split between those who were members of the permanent staff and the growing numbers of subcontracted mineworkers, who had fewer rights and privileges, particularly in respects such as medical aid and housing. Some of the interviewees emphasised their need for job satisfaction, while a small number appeared to be unsure of whether or not they were exposed to risk. Their assessments could equally plausibly be attributed to perceptions of safe working conditions as a result of having received adequate protective clothing and equipment or ignorance, in some cases.

Table 4.8: *Frequency distribution table of the perceptions of the respondents to the questionnaire of general working conditions at the WBSH mine*

Perceptions of the respondents of general working conditions at the WBSH mine

Variable	Frequency (n=40)	Percentage (%=100)
Perceptions of the respondents of general working conditions at the WBSH mine		
Satisfied	14	35
Very satisfied	18	45
Not satisfied	5	12.5
Prefer not to say	3	7.5
Availability of general medical check-ups at the mine		
Often	15	37.5

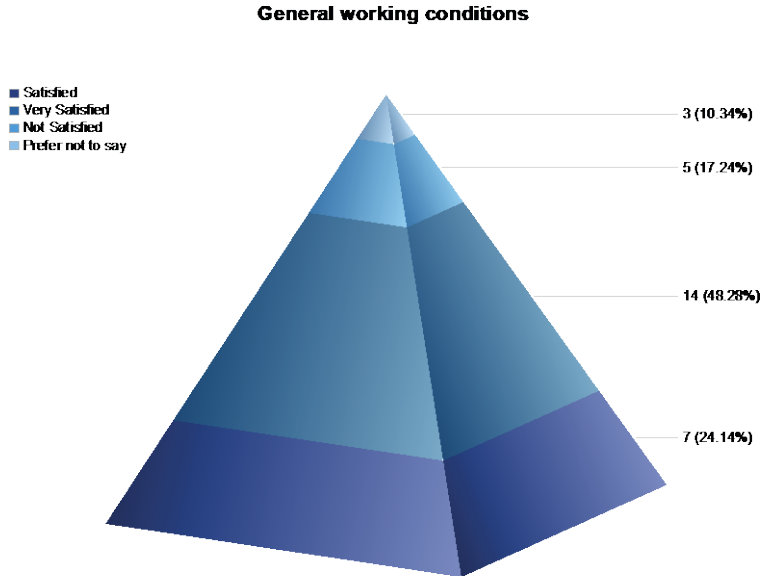


Figure 4.14: *Frequency distribution pyramid of the perceptions of the respondents of general working conditions at the WBSH mine (Author, 2020)*

The findings that are reflected in Table 4.8 and depicted graphically in Figure 4.14, together with the qualitative findings, provide a diverse range of perceptions of exposure to risk. As the data from the interviews revealed, these perceptions were influenced by factors such as the perceived quality of life of interviewees and the degree of satisfaction that they felt with respect to their incomes, social relationships, living conditions, and treatment at the mine. Those who expressed satisfaction in their work and with their working conditions would have been motivated to do so by the types of duties that they performed, their working conditions, and the durations of their working contracts. As workers with long-term contracts were not only better paid than their subcontracted counterparts, but also appeared to receive preferential treatment with respect to the allocation of protective clothing and equipment, it is highly likely that they would not perceive that they were exposed to excessive levels of risk.

By contrast, the interviews revealed that the disgruntlement of the minorities who either expressed dissatisfaction or were not prepared to comment in the questionnaire tended to result from short-term contracts and perceptions of poor working conditions as a consequence of overexposure to dangerous chemicals, which, in turn, would have been aggravated by a lack of or inadequate protective clothing and equipment, in several instances. As these respondents and interviewees tended to feel that their interests and concerns were ignored by the company, they expressed feelings of despondency towards their work, their overall morale also tended to be very low, and they perceived that their work exposed them to excessive levels of risk. As a result, their overall perceptions of the priority that was accorded to safety at the mine were also very negative.

4.6 Measures adopted by WBSH (Pty) Ltd to mitigate environmental risk at the mine

The data pertaining to the measures that the company had introduced and the procedures that were implemented at present to mitigate the levels of risk to which both employees and the environment were exposed by its operations was gathered to answer the last research question of the study. The measures that were identified from the analysis of the data are presented in the sections that follow. The findings reveal that as the management of WBSH (Pty) Ltd was aware of the risk to employees and the environment that its salt mining activities posed, it responded by introducing measures to lower the risks that it had discerned. Although the company provides regular training to its employees in the management of risk, some of the interviewees complained that they had not received any formal training from the company since their employment at the mine commenced.

4.6.1 Training and awareness

The findings revealed that most of the interviewees, particularly among those who did not have permanent employment contracts, were in favour of increasing training and awareness concerning the management of risk. The following measures were suggested by interviewees from the management of the company:

> … *"Hire a qualified environmentalist."* (Management mineworker 1)

> … *"Assign environmentally-related responsibilities to all departments."* (Management mineworker 2)

> … *"Give more information to the employees."* (Management mineworker 3)

…. *“Air pollution, the company should provide more windows for ventilation in the workshop. Provide enough fans for working in confined areas. Timing should be managed well.”* (Management mineworker 5)

… *“All employees should adhere to the set-out rules and regulations.”* (Management mineworker 8)

These excerpts suggest a general acknowledgement of the need to empower vulnerable mineworkers with knowledge of the rights that their employment confers. They also implicitly acknowledge the obligation of the management to abide by the policies of the company in relation to environmental risk and relevant legislation, including the labour laws of Namibia. By contrast, the responses of most of the mineworkers who were interviewed suggested that they believed that the company should ensure that all employees were made aware of its safety and health regulations.

4.6.2 Measures to maintain the health of mineworkers

The findings that the interviews generated indicated that most of the members of the management and general workers who participated in them emphasised that there was a general awareness of the proactive strategies that had been formulated and implemented to reduce incidences of injuries in the workplace and that medical cover was provided to all permanent employees. In the words of one of the interviewees from the management:

… *“There is a Safety and Health Department and monthly Safety and Health meetings are held to identify potential health risks. Each department has a Safety and Health Officer, who receives training each year to train others.”* (Management mineworker 1)

By contrast, one of the semi-skilled workers who was not permanently employed by the company maintained that:

… *“Environmental and safety and health policies have been drawn up, but the objectives and targets have not been set for us to follow. Identification of hazards and assessments of risk have been carried out and reviewed regularly, but me, I never received any formal training.”* (General mineworker 16)

These two excerpts suggest that perceptions pertaining to awareness of environmental risk awareness and the training that is provided by WBSH (Pty) Ltd to ensure that all employees are adequately aware can vary significantly between mineworkers and members of the management. One of the most relevant pieces of legislation that has been promulgated in

Namibia to date to safeguard the environment is the Environmental Management Act (No. 7 of 2007). According to one of the interviewees who was employed in the management of the company, the company was committed to

> … *"Creating environmental awareness among all employees."*
> (Management mineworker 3)

In the words of another member of the management:

> … *"In order to reduce workplace injuries among the employees, RISK should be considered in order to identify, quantify, and mitigate."* (Management mineworker 5)

Conversely, the responses of the general mineworkers who were interviewed appeared to suggest that levels of awareness among workers were less than optimal, particularly among semi-skilled workers from relatively poor socioeconomic backgrounds. Nonetheless, one of the members of the management explained that:

> … *"We always have a safety toolbox talk every morning, before work begins."*
> (Management mineworker 4)

A telling statistic in the findings that the administration of the questionnaire generated that are reflected in Table 4.8 was that only 37.5% of the respondents appeared to have access to regular medical check-ups, presumably as a consequence of policy that extends healthcare cover to members of the permanent staff only. These findings further underscore the complaints of the interviewees who were not members of the permanent staff that their exposure to risk and hazards and their lack of recourse to medical treatment represented unfair discrimination.

4.7 Environmental training programmes

Perceptions of the environmental training that the company provided tended to vary in accordance with the numbers of years of experience of each interviewee and the positions that they held. Interviewees who had limited working experience and were not employed on the permanent staff of the company tended to maintain that although proper training and guidance were integral components of strategies to manage environmental risk by the company and also legally required, not enough was being done to train its non-permanent employees, who were employed on a contractual basis. It emerged from the interviews that only a handful of general workers had received formal training, because of their status as members of the permanent staff. Instead of formal training, contractually employed workers

received bi-weekly briefings concerning the management of environmental risk. As one of the interviewees explained:

> …. *"The company provides training to its employees about environmental risk; the type of training is both internal and external. Job hazard analysis (JHA), identification and quantification of risk, limitations and uses of personal protective clothing and equipment, training in the use and maintenance of mining equipment, lockout procedures, and planned task observations."* (General mineworker 16)

Although this excerpt was indicative of positive perceptions of the training that is provided at the WBSH mine at present, those of interviewees who worked outside of the protection that the system provided, thereby exposing themselves to risk and injury, tended to be markedly different. Nonetheless, some 45% of the mineworkers who were interviewed made positive assessments of the environmental training programme at the WBSH mine:

> … *"Training is provided by the department related to environmental matters and other environmental issues."* (General mineworker 17)

> … *"Yes, the company provides training in safety, health, and the environment."* (General mineworker 18)

As these excerpts imply, as environmental training is an integral component of every business operation, it needs to be provided consistently, to improve relations and trust between employees and managements and increase performance, teamwork, motivation, and empowerment. In the words of one of the interviewees:

> *"Yes, the company talks about high incidence risk assessments every day and gives employees training on how to avoid causing risk and hazards to the environment."* (General mineworker 19)

Although the perceptions of mineworkers who were interviewed of the amount of training that they received from the company tended to vary, it appeared that several perceived that they were effectively precluded from receiving the training that they needed to reduce the risk to which they were exposed by their poor socioeconomic backgrounds and limited formal education. Critical realism theory holds that social, economic, and other background factors function as causal mechanisms that influence the ways in which employees are treated at work. Although the point has been alluded to previously, as many unskilled and semi-skilled workers come from poor socioeconomic backgrounds and have no other means of providing for their families, they are obliged to accept whatever opportunities for employment are

available to them, which frequently entails disregarding the levels of risk to which they are exposed as a consequence their need to secure even a meagre livelihood.

The findings in Table 4.9 demonstrate that a large majority of 85 % of the respondents to the questionnaire maintained that the company did provide training in the management of environmental risk, while a minority of 12.5 % believed that the company did not provide training and one was uncertain. These findings suggest that most of the mineworkers who were employed by WBSH (Pty) Ltd were aware of the training that the company provided, presumably as a result of attending regular monthly training sessions and bi-weekly safety and health workshops.

Table 4.9: *Frequency distribution table of perceptions of the respondents to the questionnaire of the extent to which WBSH (Pty) Ltd provided training in the management of environmental risk*

Perceptions of the respondents of the extent to which the company provided training in the management of environmental risk

Variable	Frequency (n=40)	Percentage (%=100)
Does your company provide any training to its employees concerning the management of environmental risk?		
Yes	34	85
No	5	12.5
Not sure	1	2.5

4.7.1 Measures to ensure compliance with environmental safety and health regulations

A significant response from one of the members of the management who was interviewed was the contention that general mineworkers should maintain business environments that are conducive to the sustainable creation of decent work, through the implementation of appropriate policies and adherence to regulations. The following is a representative sample of excerpts from responses from interviewees to questions concerning environmental safety and health at the WBSH mine:

> … *"Walvis Bay Salt Holdings is affiliated to the Ministry of Mines, which does regular inspections. The organisation also has a Safety and Health Budget to cater for the hazards that are identified."* (General mineworker 21)

> … *"Walvis Bay Salt Holdings should monitor, assess, improve, and Yes! Complete system and documentation in line with NOSA criteria and ISO 14001."*
> (General mineworker 28).

> … *"By ensuring that the Environmental Management Act is implemented successfully, and the company is also certified with international standards such as ISO 14000."* (General mineworker 27).

> …. *"Budget for Safety and Health and ensure that the OSHAct is complied with through doing external legal compliance audits and best practice conformance."* (General mineworker 24).

> …. *"More training and awareness of activities that harm the environment."* (Management mineworker 2).

> …. *"There should be an allocation of smoking areas in the mine."* (Management mineworker 3).

These excerpts suggest that there is a general awareness among both the management of the company and general mineworkers of the need to abide by policies and regulations pertaining to the management of environmental risk. They also suggest that although appropriate policy has been formulated, its implementation to ensure the creation of sustainable decent work had encountered several significant obstacles. The following excerpts reflect the observations of some of the interviewees:

…. *"Employees may neglect these policies; they must be monitored from time to time to make sure the activities being carried out adhere to the policies."* (General mineworker 30)

… *"No compliance by some employees."* (General mineworker 23)

… *"Persons working outside of the protection of the system and thus exposing themselves to risk and injury."* (General mineworker 26)

The need for the implementation of measures to secure economic benefits from eliminating environmental hazards and to integrate environmental guidelines into management practices pertaining to managing environmental risk at the WBSH mine were also cited by several of the interviewees as being crucial to their health and wellness at work. Three relevant excerpts from these responses were:

> … *"Asbestos is one of the issues, and a dedicated department should be established. Relevant government authorities to sensitise employees regarding environmental issues."* (General Mineworker 21)

> … *"Cleaning up of the environment in case of pollution, such as oil spills etc is really an economic issue as I believe that it's very important to implement the Environmental*

Management Act and the Environmental Management system successfully, as this will prevent any environmental fatality and promote safety and health."
(General mineworker 29)

… *"Fire risk and spillage leak, this a major economic issue as it reduces the impact on the environment, increases chances of selling the products since other people are environmentally conscious, reduce footprint, and can get rebates."*
(General mineworker 25)

4.8 Conclusion

This chapter represents an attempt to present the findings of the qualitative and quantitative studies in a sufficiently mutually supporting manner, to enable the findings that one set of data generated to corroborate those that emerged from the other. It was for this reason that findings from the administration of the survey questionnaire were included in the discussion of the qualitative findings. The principal objective of this chapter was to ensure that the findings were presented in a clear, concise, and coherent manner, to facilitate an analysis of them in relation to critical realism theory in the following chapter.

CHAPTER 5: DISCUSSION AND ANALYSIS OF THE FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

It was demonstrated in the previous chapter that there was a discernible relationship between the perceptions of the mineworkers who participated in the study of the levels and types of risk to which their work exposed them and the underlying factors that influenced the formation of the perceptions. The adaptation of critical realism theory by Oelofse (2003) to study an informal settlement in South Africa provided an appropriate means of developing an in-depth understanding of the underlying factors that influenced the perceptions of general mineworkers at the WBSH mine, which are predicated on the interactions of identifiable causal mechanisms and contingent conditions from which specific structures come into being. Consequently, the influence that the perceptions of general mineworkers exert on the decisions that they make is also mediated by a host of contingent factors, such as their socioeconomic backgrounds, levels of educational attainment, the availability of alternative forms of employment, and the degree of personal autonomy that they feel.

This chapter is premised on two interrelated assumptions that are central to the application of critical realism theory to this research context. The first is that environmental risk at the WBSH mine should be understood in terms of the causal mechanisms that shape risk events and the contingent conditions that provide the contexts in which environmental risk events occur. Secondly, the understanding of economic and political factors that influence perceptions of risk in mining communities is crucial to the successful communication and management of risk in mining. The discussion in this chapter also rests on the assumption that critical realism is not concerned principally with developing an understanding of human behaviour through the interaction of observation and reason, which is the core tenet of the positivist paradigm, or with the emphasis that the humanist paradigm places on the meanings that people ascribe to events, occurrences, or phenomena. Instead, it is a philosophical orientation that is concerned primarily with discerning underlying structures and influences, irrespective of whether or not they can be detected or known through experience or discourse alone (Bhaskar, 1975; Patomäki, 2003; Danermark, Ekström, & Karlsson, 2019). This standpoint implies that the analysis of risk should be premised on the mechanisms and conditions that shape environmental risk in mining.

Consequently, as crucial causal mechanisms and contingent conditions could be specific to particular industries, nations, or regions, investigating specific cases is likely to provide an optimal starting point for developing effective strategies to discern them (Gursory, Guinduiz,

Gazi, & Ankara, 2008). This consideration made it crucial to assess the perceptions of environmental risk of the mineworkers at the WBSH mine in relation to the specific hidden causal mechanisms and contingent conditions that could be discerned through the use of appropriate research methods. It also needs to be emphasised that the priority that mineworkers assign to their perceptions of risk is likely to be influenced by imperatives that are driven by socioeconomic, personal, and political factors. In addition, it was apparent, from direct observations, that women were effectively excluded from participating in the making of decisions concerning the levels of risk to which their work exposed them and measures to ensure their safety at the WBSH mine and from challenging the decisions that were made on their behalf by the management of the company. Consequently, gender emerged as yet another factor whose influence needed to be accorded due consideration in the final analysis of the findings.

5.2 Perceptions of environmental risk of mineworkers at the WBSH mine: Causal mechanisms

Although the researcher has referred to perceptions throughout the thesis as if the term had a single universally acknowledged meaning, the present discussion could benefit from a clarification of what it denotes for the purposes of this study. While in one sense a perception refers to an awareness of a particular presence that is gained through any of the senses, in another it refers to the subjective interpretations of individual people or groups of people of particular events, occurrences, or phenomena. It needs to be emphasised that while the first sense accords with the tenets of positivism and the second with the subjective emphasis of humanism, critical realism theory provides an additional dimension, in that both components of the concept of perception are assessed and evaluated against the workings of a real world, which are frequently not accessible to direct observation. The subjective nature of perceptions could be regarded as a defining characteristic. Although perceptions, attitudes, and values are all inherently subjective, the ways in which they interact to give rise to particular worldviews can be exceedingly complex (Oelofse, 2003).

The present perceptions of mineworkers of their working conditions at the WBSH mine stem, in part, from a generally held belief that their exclusion from the making of decisions that affect their safety, health, and overall well-being is a direct consequence of the attitudes of a management that is unable to appreciate the realities with which they are faced in their work, which have been entrenched over time. Of most concern to them were excessive levels of noise, pollution of water, land, waste, and air, and risks to health as a consequence of poor drainage, sanitation, and working conditions. The effects of these risk factors are enduring

over time and often interact with one another, frequently with disastrous cumulative consequences for miners and members of local communities.

As Oelofse (2003) defines causal mechanisms as the underlying structures that precipitate the development and occurrence of risk in societies, obtaining an in-depth understanding of the perceptions of mineworkers of environmental risk at the WBSH mine would necessarily require an understanding of the mechanisms through which risk is manifested at the mine (Esa, 2010). Among the most commonly voiced grievances of unskilled mineworkers at the WBSH mine were poor and unsafe working conditions, unregulated working hours, and overexposure to dangerous hazardous materials as a consequence of a lack of adequate protective clothing. The grim prognosis that proceeds from these findings is the likelihood of increased social unrest, more frequent and general strikes, and underdevelopment, all of which have dire implications for growth, on one hand and the plight of mineworkers, on the other.

5.2.1 The influence of globalisation and urbanisation on the perceptions of mineworkers of environmental risk: Perceptions of safety and health

Wisner, Gaillard, and Kelman (2012) explain that the effects of globalisation and urbanisation on perceptions of environmental risk should be understood as integral to the causal mechanisms that shape risk events and the contingent conditions that provide the contexts within which they occur. They also maintain that the influence that globalisation and urbanisation exert on causal mechanisms provides crucial insights into the underlying structures that shape risk events. This assessment is equally applicable to the case of the WBSH mine, as the vicissitudes and vagaries of international markets and the effects of influxes into urban centres to seek employment would inevitably have profound, if not necessarily readily explicable, effects on the complex interactions of causal mechanisms and contingent conditions (Wisner *et al.,* 2012).

Douglas (1998:108) emphasises the adverse effects of globalisation and urbanisation on overall well-being of populations in developing countries, which tends to resonate with the assessment of Xu, Feng, Li, Chen, and Jia (2017) that rapid industrialisation and urbanisation have resulted in immense environmental problems for China. Severe pollution has had extremely adverse consequences for the quality of air, climatic stability, and general health. Long-term exposure to air pollution contributes greatly to reduced life expectancy. According to the World Health Organisation, 19% of the cancer cases in the world, which result in some 1.3 million deaths each year, can be attributed to environmental and occupational factors (Li *et al.,* 2017).

In the case of the WBSH mine, the large numbers of low-skilled mineworkers who migrate from the rural areas of Namibia to seek employment at the mine have resulted in the proliferation of informal settlements in the areas that surround the mine, which have encroached into spaces that have been reserved for future investment by the mine. Occurrences of this nature oblige industrialists in developing countries to make provisions for unplanned housing, in an effort to regain access to environmental infrastructure and resources in the areas that surround their operations (Douglass, 1998:109). It is against this backdrop that the effects of globalisation and urbanisation continue to exert their respective influence on the delicate interplay between causal mechanisms and contingent conditions that shape environmental risk events at the WBSH mine (Douglass, 1998:109).

The conditions to which the escalating influxes have contributed in large part are consistent with global trends, which have resulted in the extensive documentation of the steadily widening economic and social polarisation of societies in developing countries (Douglass, 1998). The management of the WBSH mine eventually resorted to adopting unorthodox and possibly ineffective measures in an attempt to meet the need to provide training in safety and health procedures and the management of environmental risk to rapidly increasing numbers of semi-skilled mineworkers. The inevitable consequence was increased exposure of low-skilled mineworkers to occupational hazards (Douglass, 1998:121). Globalisation can have extremely detrimental consequences for both policymakers and the populations of developing countries when the interests of foreign owners are prioritised over all other considerations, frequently with irreversible devastation being suffered by surrounding environments. In these cases, poverty remains widespread after the termination of the operations that have ravaged the environment and local populations are the unfortunate inheritors of their poisoned fruits (Elliot & Thomas, 2009).

5.2.2 The influence of poverty and economic vulnerability on the perceptions of mineworkers of risk

The findings of this study tended to underscore the influence of poverty and economic vulnerability on the interplay between causal mechanisms and contingent conditions from which the perceptions of miners at the WBSH mine of the levels of risk to which their work exposed them proceeded. From the perspective of critical realism, their perceptions varied according to their socioeconomic status, their living and working conditions, and the positions that they held at work. Satterthwaite (2003) explains that unstable sources of income and either a complete lack of, or poor-quality basic services usually play a significant role in the formation of perceptions of either individual people or groups of the hazards to which employment exposes them. He holds that stable sources of income and favourable working

conditions often preclude workers from believing that they are excessively at risk. Ironically, as population influxes are likely to result in rapidly escalating rates of unemployment and diminished opportunities for employment, miners who are able to secure employment tend to disregard the risk to which their work exposes them (Bass, 2000). This assessment provides a compelling insight into the ways in which causal mechanisms and contingent conditions frequently interact with unexpected results, as in these instances perceptions of risk, for all intents and purposes, do not mediate the thinking of those who respond directly to their contingent conditions by securing employment in an attempt to confront the realities with which they perceive they are faced.

5.3 Contingent conditions and their effects on the perceptions of mineworkers of the risk to which their work exposes them

Socioeconomic factors were among the most influential contingent conditions that contributed to the ways in which mineworkers at the WBSH mine perceived and responded to the risk to which they were exposed. From the data that was presented in the previous chapter, it was evident that the measures to ensure safety and protect health that are being implemented at the WBSH mine at present are not sufficiently far-reaching, as the majority of mineworkers who have temporary contracts do not benefit from them to the extent that members of the permanent staff do, despite the extensively documented levels of risk to which they were found to be exposed. As Eiser *et al*. (2012) explain, the contingent factors or conditions that are created by temporal and local variations in an environment can exert a significant influence on the degree of risk to which workers and local populations are exposed.

Contingent conditions generally exhibit the environmental characteristics on which particular risk events and the reactions of communities or people who are affected are predicated. Anilan (2014) also contends that casual mechanisms can be derivatives of contingent factors, because their existence depends, to a large extent, on the conditions that shape particular types of risk, which are contingent factors. This conclusion implies that when certain conditions exist, other factors also come into play, either as a consequence of the creation of an environment that is conducive to their influence being felt or interactions between these factors.

It should be emphasised that the relationship between the environmental characteristics of a mine and the types and levels of risk that could be inherent in them could be either rooted in the real world of critical realism theory that has an existence independent of human perception or socially constructed (Masvaure, 2017). The degree to which risk events remain latent or manifest themselves as actual occurrences is determined, to a large extent, by the interplay

between the characteristics of particular environments and the responses of people to perceptions of risk. The noisy environment in which employees are required to work at the WBSH mine certainly contributes to a degree of entropy in which there is a high probability of other factors combining to trigger hazardous events. The machinery that is used in the mining of salt also represents another significant causal risk factor, as it was evident from the findings that faulty, improperly or inadequately maintained, or old equipment placed mineworkers at a high risk of coming into contact with hazardous materials or substances.

5.4.1 Timing of events

The timing of events as a causal mechanism can have profound implications for the unfolding of risk events, as it is influenced by a range of different social, economic, and political factors that contribute significantly to the shaping of eventual outcomes. In the case of the mineworkers at the WBSH mine, irrespective of their wages and working conditions, their experiences occur within a real world that is characterised by political change, in the sense of being citizens of a democratic society, and a growing awareness of the need to preserve natural environments. Although this assessment in itself could be dismissed as an expression of naive optimism and is also incomplete, it nonetheless identifies causal mechanisms that could play an increasingly significant role in the playing out of the pitting of their interests against the financial imperatives of the company.

Consequently, their perceptions of the risk to which their work exposes them and the damage that it is allowed to inflict on the environment are inevitably likely to be formed as a result of the interactions of a number of different causal mechanisms, in forms such as the contributions of the unions to which they are affiliated and the government to the upholding of their rights in respects such as safety and health at work and acceptable wages, and the pressure that is brought to bear on mining companies to ensure the safety and health of all employees, to provide adequate remuneration, and to abide by the environmental legislation and regulations of the country.

5.5 Review of the research problem and the aim and objectives of the study

The purpose of this section is to enable a comprehensive appraisal to be made of the extent to which the aim and objectives of the study have been achieved. Although the study was primarily concerned with evaluating the perceptions of general mineworkers of the risk to which their work exposed them and their environment, a dominant theme that emerged from the findings concerned their exclusion from the making of decisions pertaining to the management of risk, decisions that had a direct bearing on their safety, health, and overall well-being. It was envisaged that the findings from the study could provide the basis for

formulating responsible principles or guidelines for developing appropriate policies and measures to limit the risk to which general mineworkers are exposed.
A significant finding was that many mineworkers appeared not even to be aware of the degree of risk to which their work exposed them or their environment. It has direct relevance to the first of the objectives of the study, namely, to determine how general mineworkers perceive environmental risk at the WBSH mine. As the qualitative findings revealed, although there appeared to be widespread ignorance of the consequences of the operations of the mine for the environment, several of the general mineworkers who were interviewed expressed an awareness of environmental legislation and regulations and believed that they should be adhered to.

The question that the second objective articulates, namely, why general mineworkers perceive environmental risk as they do, appeared to have a disparate range of possible answers. For those who were not aware of the risk that their work posed to themselves or the environment, the obvious answer would have been ignorance, often as a consequence of a lack of or little formal education. Secondly, it has also been noted that perceptions of risk often tend to recede in the face of more immediately pressing concerns, such as the need to secure a livelihood when opportunities for employment are scarce. In addition, the effects of cognitive dissonance should not be underestimated either. Some of the interviewees were acutely aware of the extremely hazardous nature of the chemicals and substances with which they worked, as they had experienced direct exposure to them, in forms such as acid burns and the inhalation of ammonia. Just as many smokers are aware of the real possibility of succumbing to cancer or suffering from respiratory ailments such as emphysema, they appear to be able to compartmentalise their concerns, as a strategy for postponing foregoing the pleasure that they derive from smoking. It also needs to be emphasised that evidence of cognitive dissonance is prolific throughout the industrial nations of the world, as highly educated industrialists seek to circumvent legislation pertaining to pollution and degradation of the environment in their endeavours to maximise short-term profits.

The third objective was to determine whether any intervention strategies were being implemented, either by general mineworkers or the management of the mine, to reduce or prevent environmental risk at the mine. A significant majority of the respondents to the questionnaire indicated their awareness of the training that the company provided in the management of environmental risk, a finding that was extensively elaborated upon in the interviews. Although it was found that formal training was provided to members of the permanent staff and bi-weekly briefings and workshops to contractual workers, general mineworkers who were interviewed raised questions concerning how effective these

measures had been and whether they had served their intended purposes. The ravages that have been inflicted on local flora, which were covered in section 4.3.1.2, serve as a grim and permanent reminder of the irreversible destructive changes to the local ecology that have occurred, all commitments to preserving the environment that have been verbalised notwithstanding.

5.5.1 Review of critical realism theory and its application in this study

Critical realism theory holds that the real world is stratified and differentiated and made up of events, mechanisms, and structures, in an open system of complex interactions between structure and structural representations, whose consequences provide answers to questions that the interactions elicit (Cloke *et al.,* 1991:146). Accordingly, it was necessary to endeavour to identify the causal mechanisms and contingent factors whose interactions shaped the playing out of risk events at the WBSH mine. While causal mechanisms were identified as factors that are manifested as socioeconomic and political influences that, combined with contingent conditions, play out as risk events, either potential or actual, in different local contexts (Raza & Andrew, 2001). Causal mechanisms are not mutually exclusive. As they are interconnected, overlap, and each carries a broad and complex literature with it, the role of each identifiable causal mechanism needed to be taken adequately into account to obtain a sufficiently comprehensive understanding of the perceptions of mineworkers of environmental risk at the WBSH mine.

The causal mechanisms and contingent conditions that were investigated had been activated by increased risk for large numbers of employees at the WBSH mine, deteriorating working conditions, and escalating numbers of short-term employment contracts, which resulted in a decrease in both the overall well-being of mineworkers and the standards of living that they were able to enjoy. Accordingly, the shifts in their perceptions that have resulted from the interactions between the causal mechanisms and contingent conditions that have been identified are reflected in significant changes to structures, outcomes, events, and the contingent conditions at the WBSH mine themselves.

5.6 Recommendations from the conclusions of this study

The following recommendations are made on the basis of the conclusions that were drawn from the findings of this study:

- More general mineworkers should be included in the making of decisions concerning the management of environmental risk, irrespective of their socioeconomic backgrounds or levels of educational attainment, to strengthen relations between general workers and the management, reduce sources of potential conflict, and to

prevent conflicts of interest from developing (Docherty, 2003; Bennett, 2008; Edo, 2017).

- Efforts to ensure the safety and health of mineworkers and to provide them with safe working conditions should be increased significantly, to reduce the levels of risk to which both mineworkers and the environment are exposed. In addition, all mineworkers, irrespective of whether they are contractual workers or members of the permanent staff, should be provided with adequate protective clothing and equipment.
- The correct and consistent implementation of sound policies to mitigate environmental risk should be a priority to which the management attends through regular and rigorous monitoring.
- Additional training is required to educate mineworkers to recognise instances of potential risk, both to themselves and the environment.

These recommendations are elaborated upon in the sections that follow.

5.6.1 Inclusion of mineworkers in the making of decisions pertaining to the management of environmental risk

This recommendation is informed by the contention of Bennett (2006) that participation by the public in the making of decisions that have direct consequences for the interests of its members empowers, informs, and promotes a sense of collective civic responsibility. The empowerment of miners confers on them the authority to make decisions that improve the quality of their working lives. Assigning responsibility to the people who are most affected by particular circumstances or conditions also empowers them to contribute significantly to the making of decisions to make their environments safe (Docherty, 2003). Consequently, it is the responsibility of the company to ensure that it provides training in the management of environmental risk that equips mineworkers to make appropriate decisions in their responses to complex circumstances in their working environment (Lester, 2008).

It is also recommended that the management should consider optimising social conditions at the mine, in the interests of increasing productivity from an increased sense of fulfilment at the workplace among general mineworkers. Providing regular training to workers in effectively participating in making decisions pertaining to the management of environmental risk would contribute significantly to reducing conflicts of interest and disagreements between general mineworkers and the management (Masvaure, 2017). Accordingly, the overall responsibilities of mining companies are not confined to the management and minimisation of environmental risk, but also extend to the communication of environmental risk to general mineworkers and local populations. In addition, appropriate legislation should be formulated and implemented

to provide transparent and inclusive procedures to ensure the active participation of mineworkers and the members of local populations in the management of environmental risk, in accordance with internationally recognised standards and practices.

5.6.2 Improving the working and living conditions of mineworkers

As the working and living conditions of mineworkers are the direct result of the historical development of mining in southern Africa and have remained essentially unchanged since the early 1800s, appropriate changes that reflect the transitions that countries have undergone from colonial rule to young democracies are urgently needed (Rabe, 2006; Masvaure, 2017). Although unions have played a significantly increased role in campaigning for improved wages and working conditions for mineworkers since towards the end of the apartheid era in both South Africa and present-day Namibia, there is abundant evidence, including among the data that this study generated, that their rights are not sufficiently comprehensively recognised and upheld to ensure that they are treated as citizens of democracies, as the Marikana incident readily attests, to cite but a single instance.

5.6.3 Appropriate integration and implementation of environmental policies to reduce environmental risk in the mining sector

The final recommendation is a robust integration and implementation of environmental policies to reduce environmental risk in mining. The findings that the data that this study generated strongly suggest that most general mineworkers need more clarity and guidance with respect to the correct implementation of policies or practices to ensure the sustainability of the environment. Accordingly, it is recommended that mining companies should be required to provide clear guidelines and regulations for the implementation of environmental policies and measures to ensure the safety and health of mineworkers. The need for mining companies to make mineworkers adequately aware of environmental legislation and policies, as it was evident that many of the mineworkers who participated in this study were not aware of their existence or of policies and regulations to ensure their safety and health at work.

5.7 Contributions of this research study

As this research study was conducted primarily to evaluate the extent to which general mineworkers at the WBSH mine were aware of the levels of risk to which their working environment and their work exposed them, it represents an attempt to elicit meaningful information concerning the hazards to which a local environment is subjected by mining operations and the degree to which the safety and health of employees are jeopardised from the perspectives of the people who are most affected. Consequently, the findings of the study

should be of interest to policymakers and planners who are concerned specifically with safeguarding the well-being of mineworkers and obliging mining companies to make an adequate commitment to ensuring the sustainability of the environment.

5.7.1 Contribution to the existing body of knowledge

Critical realism theory was consciously adopted to provide a relevant theoretical basis for this study after the researcher had conducted an extensive review of its application in the published research of Catherine Oelofse, which had revealed the degree to which the orientation could be applied to assessments of environmental risk to produce a depth of understanding of risk events that was not possible through the use of other methods. Consequently, the study represents an attempt to extend the remit of critical realism theory in phenomenological analysis, in a study of the perceptions of mineworkers, whose published findings should make a significant contribution to the body of knowledge that has been generated to date.

5.8 Limitations of the study and suggestions for further research

The inherent limitations of all qualitative research stem from the subjective factors that influence the choices that individual researchers make with respect to research designs and methodologies and the extent to which personal biases influence the interpretation of the data that studies generate. The researcher endeavoured to overcome this limitation by collecting data from several different sources and also through the use of two different sets of methods to collect and analyse the quantitative and qualitative data (Neuendorf, 2016).

5.8.1 Suggestions for further research

Future research should make use of larger research samples than were possible in this study and include other mining companies in the main provinces of Namibia and other southern African regions, to develop a more broad-based assessment of the perceptions of general mineworkers of the types and levels of risk to which their work exposes them and their environment. In addition, a comparative study of the strategies that mining companies have developed to improve general living and working conditions for miners in the post-colonial eras of their countries and the implementation of sound policies to combat environmental risk that express their individual visions, missions, and environmental policies would provide a highly meaningful counterpoint to the findings of qualitative studies of perceptions.

5.9 Conclusion

As it has been demonstrated in this chapter, the evaluation of the extent to which the aim and objectives of this study had been met enabled the research questions that guided the conducting of it to be answered. Although the findings of the study are of great potential value to workers in a number of environmentally-orientated disciplines, they nonetheless shed light on the still uncertain status of mineworkers in the young country of Namibia, as political emancipation has yet been matched with working and living conditions that should be the inalienable rights of citizens of any country whose chief priority is the health, happiness, and well-being of its people.

5.10 Reflections on the trajectory of the study

An accurate account of the course that this study followed, from the initial formulation of the research topic until the production of a thesis that would satisfy the requirements of a Master's degree, would be woefully incomplete without covering some of the immense frustrations that qualitative researchers are likely to encounter in the baptism of fire that a first foray into qualitative research is likely to entail (Altheide & Johnson, 2011). The fieldwork was a difficult undertaking, owing to the great distance of the location at which the data was gathered and the home of the researcher, which was further compounded by a lack of reliable transport. Revisiting the area proved to be extremely difficult, as it was extremely unsafe for members of the general public who were not as accustomed as the mineworkers who worked at the mine to the hazards that lay in wait for the unsuspecting. In many instances, it was difficult to keep appointments for interviews, which were frequently delayed, postponed to another date or venue, or simply cancelled at the last minute. The frustrating experiences required immense patience and diligence, to enable the researcher to complete the study.

The coronavirus pandemic severely restricted the researcher's movements towards the end of this study and obliged her to do all of the general administrative work to complete the study online, which required a great deal of rapid adjustment. The difficulties that were experienced were also further exacerbated by either poor or intermittent access to the internet. Conducting the research nonetheless was a very inspiring experience, as it taught the researcher to develop the means to overcome any adverse contingencies that arose, without giving up or being distracted from achieving her overall goals. Figure 5.1 is a flowchart that summarises the stages through which the research study proceeded, from its initial formulation and conceptualisation to the completed thesis. The rectangular blocks in the flowchart indicate the procedures that were followed, while the diamond shapes indicate points at which specific decisions were made.

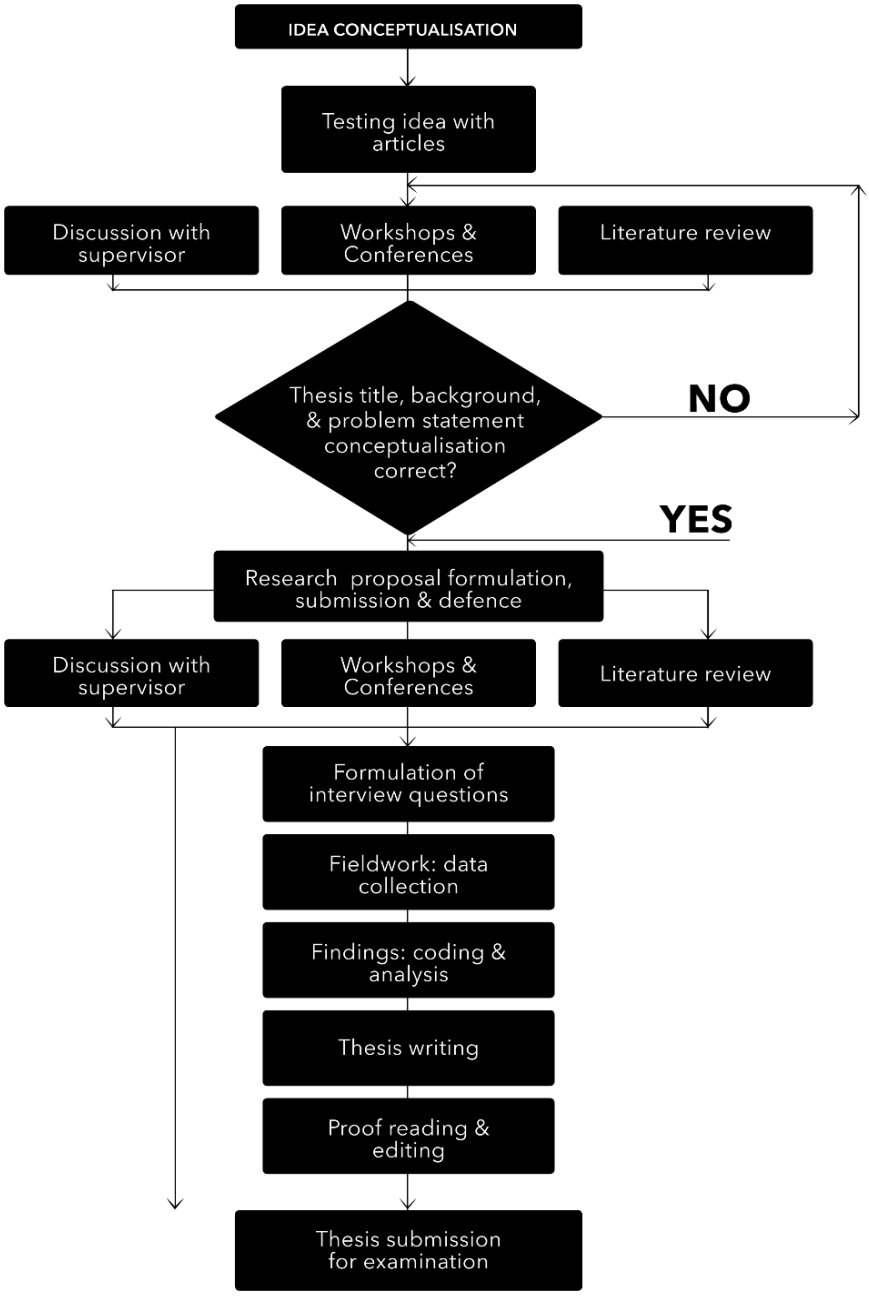


Figure 5.1: *Flowchart summarising the stages through which the study passed*

REFERENCES

Altheide, D. & Johnson, J. 2011. Reflections on interpretive adequacy in qualitative research. In Denzin, N.K. & Lincoln, Y. (eds). The Sage handbook of qualitative research. Thousand Oaks, CA: Sage Publications: 581-594.

Amukugo, H.J. 2009. A model to facilitate male partner involvement in the reproductive health context in Oshikoto region Namibia. Unpublished PhD thesis, University of Namibia, Windhoek.

Anilan, B. 2014. A study of the environmental risk perceptions and environmental awareness levels of high school students. Asia-Pacific Forum on Science Learning and Teaching, 15(2): 1.

Anon. 2020. 2018 AGM Meeting Reports - Intergovernmental Forum. Intergovernmental Forum. https://www.igfmining.org/2018-agm-meeting-reports/ 26 October 2020.

Auerbach, C.F. & Silverstein, L.B. 2003. Qualitative data: An introduction to coding and analysis. New York, NY: New York University Press.

Babbie, E.R. 1995. The practice of social research. 7th ed. Belmont, CA: Wadsworth.

Babbie, E. & Mouton, J. 2001. The practice of social research: South African edition. Cape Town: Oxford University Press Southern Africa.

Babbie, E.R. 2013. The practice of social research. 13th ed. Belmont, CA: Wadsworth Cengage Learning.

Bailey, P., Thomsen, G.E., Spuhler, V.J., Blair, R., Jewkes, J., Bezdjian, L., Veale, K., Rodriquez, L., & Hopkins, R.O. 2007. Early activity is feasible and safe in respiratory failure patients. Critical care medicine, 35(1): 139-145.

Bass, B.M. 2000. The future of leadership in learning organizations. Journal of Leadership Studies, 7(3): 18-40.

Bass, R. 2000. Heaven or hell? Hout Bay's informal settlement. Mail and Guardian: August 25–31.

Baxter, J. & Eyles, J. 1997. Evaluating qualitative research in social geography: Establishing 'rigour' in interview analysis. Transactions of the Institute of British Geographers, 22(4): 505-525.

Bazeley, P. 2009. Analysing qualitative data: More than 'identifying themes'. Malaysian Journal of Qualitative Research, 2(2): 6-22.

Beck, U. 1992. From industrial society to the risk society: Questions of survival, social structure, and ecological enlightenment. Theory, Culture, & Society, 9(1): 97-123.

Beiske, B. 2007. Research methods: Uses and limitations of questionnaires, interviews, and case studies. Munich: GRIN Publishing.

Bell, E. & Bryman, A. 2007. The ethics of management research: An exploratory content analysis. British Journal of Management, 18(1): 63-77.

Bennett, R. 2006. Employee relations. Harlow: Pearson Education Limited.

Bernard, H.R., Wutich, A., & Ryan, G.W. 2016. Analysing qualitative data: Systematic approaches. Thousand Oaks, CA: SAGE Publications.

Bezuidenhout, A. & Buhlungu, S. 2011. From compounded to fragmented labour: Mineworkers and the demise of compounds in South Africa. Antipode, 43(2): 237–263.

Bhaskar, R. 1978. A realist theory of science. Hemel Hempstead: Harvester Press.

Bhattacherjee, A. 2012. Social science research: Principles, methods, and practices. Athens, GA: Global Text Project.

Blaikie, N. 1991. A critique of the use of triangulation in social research. Quality & Quantity: International Journal of Methodology, 25(2):115-136.

Bohle, P. & Quinlan, M. 2000. Managing occupational health and safety: A multidisciplinary approach. South Yarra, Victoria: Macmillan Education AU.

Botta, S., Comoglio, C., Quaglino, A., & Torchia, A. 2009. Implementation of environmental management systems in the extraction of construction aggregates from gravel pit lakes. American Journal of Environmental Sciences, 5(4): 526–534.

Bowen, G.A. 2008. Naturalistic inquiry and the saturation concept: A research note. Qualitative Research, 8(1): 137-152.

Boyatzis, R.E. 1998. Transforming qualitative information: Thematic analysis and code development. Thousand Oaks, CA: Sage.

Braun, V. & Clarke, V. 2006. Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2): 77–101.

Brooks, S., Sutherland, C., Scott, D., & Guy, H. 2010. Integrating qualitative methodologies into risk assessment: Insights from South Durban. South African Journal of Science, 106(9-10): 1-10.

Bryceson, D. & MacKinnon, D. 2012. Eureka and beyond: Mining's impact on African urbanisation. Journal of Contemporary African Studies, 30(4): 513-537.

Bryman, A. 2007. Barriers to integrating quantitative and qualitative research. Journal of Mixed Methods Research, 1(1): 8–22.

Bryman, A. 2012. Social research methods (4th ed). New York, NY: Oxford University Press.

Burgman, M. 2005. Risks and decisions for conservation and environmental management. Cambridge: Cambridge University Press.

Burrell, G. & Morgan, G. 2006. Sociological paradigms and organisational analysis. Aldershot: Gower.

Caracelli, V.J. & Greene, J.C. 1993. Data analysis strategies for mixed-method evaluation designs. Educational evaluation and policy analysis, 15(2): 195-207.

Clark, G.E., Moser, S.C., Ratick, S.J., Dow, K., Meyer, W.B., Emani, S., Jin, W., Kasperson, J.X., Kasperson, R.E., & Schwarz, H.E.1998. Assessing the vulnerability of coastal

communities to extreme storms: The case of Revere, MA., USA. Mitigation and Adaptation Strategies for Global Change, 3(1): 59-82.

Cloke, P., Philo, C., & Sadler, D. 1991. Approaching human geography: An introduction to contemporary theoretical debates. London: Paul Chapman Publishing Ltd.

Crawford-Brown, D.J. 1999. Risk-based environmental decisions: Methods and culture. New York, NY: Kluwer Academic Publishers.

Creswell, J.W. & Plano Clark, V.L. 2011. Designing and conducting mixed methods research (2nd ed). Thousand Oaks, CA: Sage Publications.

Creswell, J. W. 2003. Research design: Qualitative, quantitative, and mixed methods approaches (2nd ed). Thousand Oaks, CA: Sage Publications.

Creswell, J.W. & Creswell, J.D. 2017. Research design: Qualitative, quantitative, and mixed methods approaches. Thousand Oaks, CA: Sage Publications.

Creswell, J.W.1999. Mixed-methods research: Introduction and application. In Cizek, G. (ed). Handbook of educational policy. Cambridge, MA: Academic Press.

Crush, J., Jeeves, A., & Yudelman, D. 1991. South Africa's labour empire: A history of black migrancy to the gold mines. Cape Town/Boulder: David Phillip/Westview Press.

Crush, J., & McDonald, D.A. 2001. Introduction to special issue: Evaluating South African immigration policy after apartheid. Africa Today: 1-13.

Crush, J. & Tshitereke, C. 2001. Contesting migrancy: the foreign labor debate in post-1994 South Africa. Africa today: 49-70.

Danermark, B., Ekström, M., & Karlsson, J.C. 2019. Explaining society: Critical realism in the social sciences. London: Routledge.

Decrop, A. 1999. Triangulation in qualitative tourism research. Tourism Management, 20(1): 157-161.

De Vos, A.S., Delport, C.S.L., Fouché, C.B., & Strydom, H. 2011. Research at grass roots: A primer for the social science and human professions. Pretoria: Van Schaik Publishers.

Denzin, N.K. 2017. The research act: A theoretical introduction to sociological methods. Piscataway, NJ: Transaction Publishers.

Docherty, B. 2007. The time is now: A historical argument for a cluster munitions convention, Harvard Human Rights Journal, 20: 53.

Douglass, M. 1998 World city formation on the Asia Pacific Rim: Poverty, 'everyday' forms of civil society, and environmental management. In Douglass, M. & Friedman, J (eds). Cities for citizens. Chichester: John Wiley & Sons: 107-138.

Easterby-Smith, M.T., Thorpe, R., & Lowe, A. 1991. Management research: An introduction. London: Sage.

EIA. 2012. Annual Coal Distribution Report. Archive (2014, 2013, 2012). Domestic distribution of US coal by destination State, consumer, destination, and method of transportation, Texas.

EIA. 2016. Capital cost estimates for utility scale electricity generating plants. US Energy Information Administration Report.

Eiser, J.R., Bostrom, A., Burton, I., Johnston, D.M., McClure, J., Paton, D., Van de Pligt, J., & White, M.P. 2012. Risk interpretation and action: A conceptual framework for responses to natural hazards. International Journal of Disaster Risk Reduction, 1:5–16.

Elliot, M. & Thomas I. 2009. Environmental impact assessment in Australia: Theory and practice. Alexandria, NSW: The Federation Press.

Engelbrecht, J.Z. 2011. An analysis of the sustainable mining of selected minerals and metals in South Africa. Unpublished PhD thesis, North-West University, Potchefstroom.

Esa, N. 2010. Environmental knowledge, attitude, and practices of student teachers. International Research in Geographical and Environmental Education, 19(1):39-50.

Esi, Y. 2012. The effect of health and safety standards on productivity in Ghana Rubber Estates Limited. Unpublished PhD thesis, Institute of Distance Learning, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

European Commission 2015. Science for environment policy. Thematic Issue: Integrating environmental risk assessment.

Feinstein, C.H. 2005. An economic history of South Africa: Conquest, discrimination, and development. Cambridge: Cambridge University Press.

Fernandes, W.A. 2014. The role of mining in economic development in Namibia post 2008 global economic crisis. Unpublished PhD thesis, University of the Witwatersrand, Johannesburg.

Finch, H. & Lewis, J. 2003. Focus groups. In Ritchie, J. & Lewis, J. (eds). Qualitative research practice: A guide for social science students and researchers. Thousand Oaks, CA: Sage: 170-198.

Flick, U. 2011. Triangulation. In Oelerich, G. & Otto, H-U (eds). Empirische forschung und soziale arbeit. Wiesbaden: VS Verlag für Sozialwissenschaften: 323-328.

Flick, U., Von Kardoff, E., & Steinke, E. 2004. A companion to qualitative research. London: Sage.

Foot, S., Rigby, D., & Webber, M. 1989. Theory and measurement in historical materialism. In Kobayashi, A. & MacKenzie, S. (eds). Remaking human geography. London: Unwin Hyman: 116-133.

Freund, B., 2006. A History of struggle The History of Black Mineworkers in South Africa (3 vols.). Volume I: Mining in South Africa and the Genesis of Apartheid 1871–1948.

Volume II: Apartheid Repression and Dissent in the Mines 1948–1982. Volume III: Organise or Die! 1982–1994. By VL ALLEN (vol. III assisted by Kate Carey). Keighley: Moor Press; London: Merlin, 1992, 2003, 2003. Pp.(I) xx+ 491;(II) xx+ 489;(III) xxiii+ 745. £ 100 the set of 3 vols. (ISBN 0-85036-5651; 0-85036-566x; 0-85036-567-8). The Journal of African History, 47(2): 338-341.

Gawaikar, V., Bhole, A.G., & Lakhe, R.R. 2018. Measuring the impact of ISO 14001 implementation. Polish Journal of Environmental Studies, 27(2): 637–646.

Gravetter, F. & Forzano, L. 2009. Research methods for behavioural sciences (3rd ed). Boston, MA: Wadsworth Cengage Learning.

Guba, E.G. & Lincoln, Y.S.1981. Effective evaluation: Improving the usefulness of evaluation results through responsive and naturalistic approaches. Hoboken, NJ: Jossey-Bass.

Guba, E.G. & Lincoln, Y.S. 1988. Do inquiry paradigms imply inquiry methodologies? In Fetterman, D.M. (ed). Qualitative approaches to evaluation in education: The silent scientific revolution. London: Praeger: 89-115.

Gürsoy, Ş.T., Gündüz, T., Gazi, K. C., AnkaraÇiçekioğlu, M., Börekçi, N., Soyer, M.T., & Öcek, Z. 2008. İzmir Karşıyaka Belediye çalışanlarında çevresel risk algılama düzeyi. Wwwankara enviromentariskie'.abnc_cncx.abxc…/ [Accessed on 2 September 2017].

Hacking, I. 2002. Historical ontology. In Gardenfors, P., Wolenski, J., & Kijania-Placek, K. (eds). In the scope of logic, methodology, and philosophy of science. Dordrecht: Springer: 583-600.

Hadden, S. G. 1991. Public perception of hazardous waste. Risk Analysis, 11(1): 47-57.

Hamann, R. 2004. Corporate social responsibility, partnerships, and institutional change: The case of mining companies in South Africa. Natural Resources Forum 28(4): 278-290.

Hancock, B., Windridge, K., & Ockleford, E. 2009. An introduction to qualitative research. The NIHR Research Design Service for Yorkshire & the Humber. Retrieved from www.rdseastmidlands.nihr.ac.uk.

Harding, R. 1998. Uncertainty, risk, and the precautionary principle. In Harding, R. & Fisher, E. (eds). Perspectives on the precautionary principle. Sydney: Federation Press. 1999.

Hennick, M., Hutter, I., & Bailey, A. 2011. Qualitative research methods. London and Thousand Oaks, CA: Sage.

Hesse-Biber, S.N. & Leavy, P. 2010. The practice of qualitative research. Thousand Oaks, CA: Sage.

Hill, C.E. 2012. Consensual qualitative research: A practical resource for investigating social science phenomena. Washington, D.C.: American Psychological Association.

Hill, E.M. 2012. Noise sensitivity and diminished health: The role of stress-related factors. Unpublished PhD thesis, Auckland University of Technology, Auckland.

Hyett, D. 2010. Environmental risk assessment in environmental impact assessment: Optional or mandatory? In 30th annual meeting of the International Association for Impact Assessment Conferences: The role of impact assessment in transitioning to the Green Economy, Geneva, 6-11 April 2010: 1-6.

Judd, D., Surridge, K.T., & Surridge, K. 2013.The Boer War: A history. London: IB Tauris.

Kane-Berman, J. 2017. Mining in SA: Then, now, and into the future. The Institute of Race Relations, 15.

Karasar, N. 2005. Environmental risks. Ankara: Nobel Akademik Yayincilik.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J., & Ratick, S. 1998. The social amplification of risk: A conceptual framework. In Lofstedt, R. & Frewer, L. (eds). The Earthscan reader in risk and modern society. London: Earthscan: 149-162.

Kennedy, A., Schafft, K.A., & Howard, T.M. 2017. Taking away David's sling: environmental justice and land-use conflict in extractive resource development. Local Environment, 22(8): 952-968.

King, G., Keohane, R.O., & Verba, S.1994. Designing social inquiry: Scientific inference in qualitative research. Princeton, NJ: Princeton University Press.

Kotze, A. J. 1994. Occupational health for the nurse and other health workers. Cape Town: Juta.

Krefting, L. 1991. Rigour in qualitative research: The assessment of trustworthiness. American Journal of Occupational Therapy, 45(3): 214-222.

Krueger, R.A. & Casey, M.A. 2000. Focus groups: A practical guide for applied research. Thousand Oaks, CA: Sage.

Kumar, R. 2018. Research methodology: A step-by-step guide for beginners. Thousand Oaks, CA: Sage.

Leavy, P. 2017. Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. New York, NY: Guilford Publications.

Leedy, P.D. & Ormrod, J.E. 2010. Practical research: Planning and design. Hoboken, NJ: Prentice Hall.

Lester, C. & Matella, M. 2016. Managing the coastal squeeze: Resilience planning for shoreline residential development. Stanford Environmental Law Journal, 36: 23.

Lester, D.B. 2008. Employee participation in decision making in the mining sector. Unpublished research paper towards an MPhil degree, University of the Western Cape, Cape Town.

Lofstedt, R. & Frewer, L. (eds). 1998. The Earthscan reader in risk and modern society. London: Earthscan.

Mabasa, K. & Chinguno, C.2018. Trade union organising in the mining sector. The Future of Mining in South Africa: Sunset or Sunrise?,:298.

MacDonald, S. & Headlam, N. 2009. Research methods handbook: Introductory guide to research methods for social research. Manchester: Centre for Local Economic Strategies.

Mack, N., Woodsong, C., MacQueen, K.M., & Guest, G. 2005. Qualitative research methods: A data collector's field guide. Durham, NC: Family Health International.

Mansfeld, C. 2006. Environmental impacts of prospecting and mining in Namibian national parks: Implications for legislative compliance. Unpublished Master's thesis. Stellenbosch University, Stellenbosch.

Maree, K. 2007. First steps in research. Pretoria: Van Schaik Publishers.

Marsh, J. & Oelofse, C. 1998. Risk assessment: Environmental training for development facilitators. Cape Town: University of Cape Town.

Mason, D. 1980. Industrialisation, race, and class conflict in South Africa: Towards a sociological resolution of a reopened debate. Ethnic and Racial Studies, 3(2): 140-155.

Masondo, S. & Lektjolo, N. 2010. Balfour protesters take aim at Zuma. The Times: February 8. http://www.timeslive.co.za/news/article297907.ece/Balfour-protesterstake-aim-at-Zuma [Accessed 16 June 2018].

Masondo, S. 2010. Mining devastating SA's farms: How rampant mining is destroying SA's breadbasket. The Times: January 24. http://www.timeslive.co.za/news/article275637.ece [Accessed 20 June 2018].

Masuku, S. 2011. The instructional leadership role of the high school head in creating a culture of teaching and learning in Zimbabwe. Unpublished doctoral thesis, University of South Africa, Pretoria.

Masvaure, P. 2017. Marange diamond mining industry: Socio-political environment and its role on psychological well-being and organisational citizenship of diamond miners in Marange, Zimbabwe. Unpublished PhD thesis, University of KwaZulu-Natal, Durban.

Miles, M.B., Huberman, A.M., Saldana, J. 2013 Qualitative data analysis: A methods sourcebook. Thousand Oaks, CA: Sage.

Mink, G. (ed). 1999. Whose welfare? New York: Cornell University Press.

Mir, R. & Watson, A. 2001. Critical realism and constructivism in strategy research: Toward a synthesis. Strategic Management Journal, 22(12) .1169-1173.

Moodie, T.D. & Ndatshe, V. 1994. Going for gold: Men, mines, and migration. Johannesburg: Witwatersrand University Press.

Moodie, T.D. & Ndatshe, V. 1992. Town women and country wives: Migrant labour, family politics, and housing preferences at Vaal Reef mine. Labour, Capital, and Society, 25(1): 116-132.

Moran, E.F. 2010. Environmental social science: Human-environment interactions and sustainability. Oxford: John Wiley & Sons.

Morgan, M.G., Fischhoff, B., Bostrom, A., & Atman, C.J. 2002. Risk communication: A mental models approach. Cambridge: Cambridge University Press.

Morodi, T.J. 2016. The precautionary principle and public environmental decision making in South Africa: An ethical appraisal. Unpublished PhD thesis, Stellenbosch: Stellenbosch University.

Morse, J.M. 2010. Sampling in grounded theory. In Bryant, A. & Charmaz, C. (eds). The SAGE handbook of grounded theory. Thousand Oaks, CA: Sage: 229-244.

Namibia (Republic of). 1994. Namibia's Environmental Assessment Policy. Windhoek: Ministry of Environment and Tourism.

Namibia (Republic of). 2004. Minerals Policy. Windhoek: Ministry of Environment and Tourism.

Namibia (Republic of). 2006. National Occupational Health Policy. Windhoek: Ministry of Health and Social Services.

Neuendorf, K.A. 2016. The content analysis guidebook. London: Sage.

Neuman, W. L. 2011. Social research methods: Qualitative and quantitative approaches (6th ed). Boston, MA: Pearson Educational.

Newell, P. & Paterson, M. 2010. Climate capitalism: Global warming and the transformation of the global economy. Cambridge: Cambridge University Press.

Oelofse, C.G. & Dodson, B. 1997. Community, place, and transformation: A perceptual analysis of residents' responses to an informal settlement in Hout Bay, South Africa. Geoforum, 28(1): 91–100.

Oelofse, C.G. & Patel, Z. 2000. Falling through the net: Sustainability in Clermont Township, Durban. South African Geographical Journal, 82(2): 35–43.

Oelofse, C.G. 1994. The surrounding community's perception of the development of an informal settlement in their area: A case study of Hout Bay, Cape. Unpublished Master's thesis, University of Cape Town, Cape Town.

Oelofse, C.G. 1996a. The Integration of three disparate communities: The myths and realities facing Hout Bay, Cape Town. In Davies, R.J. (ed). Contemporary city structuring: International insights. Cape Town: IGU Commission on Urban Development: 275-286.

Oelofse, C.G. 1996b. Environmental perceptions of informal settlers and the development of appropriate environmental education programs. Pretoria: CSD report.

Oelofse, C.G. 1997. Critical realism and changing urban spaces: A case study of an informal settlement in Hout Bay, South Africa. Paper presented at the Society of South African Geographers International Conference on Environment and Development in Africa: An agenda and solutions for the 21st century, Pretoria, 29 June–3 July 1997.

Oelofse, C.G. 2002. Dimensions of urban risk. In Nomdo, C. & Coetzee, E.(eds). Urban vulnerability: Perspectives from South Africa. Cape Town: Periperi Publications.

Oelofse, C.G. 2003. A critical realist perspective on urban environmental risk: A case study of an informal settlement in South Africa. Local Environment, 8(3): 261–275.

O'Meara, D. 1975. The 1946 African mineworkers' strike and the political economy of South Africa. Journal of Comparative and Commonwealth Politics, 13(2): 146-173. DOI: 10.1080/14662047508447235.

Onwuegbuzie, A.J. & Leech, N.L. 2007. Sampling designs in qualitative research: Making the sampling process more public. Qualitative Report, 12(2): 238-254.

Pacione, M. 1982. The use of objective and subjective measures of life quality in human geography. Progress in Human Geography, 6(4): 495-514.

Packard, R.M. 1989. The "healthy reserve" and the "dressed native": Discourses on black health and the language of legitimation in South Africa. American Ethnologist, 16(4): 686-703.

Patomäki, H. 2003. After international relations: critical realism and the (re)construction of world politics. Routledge.

Patton, M.Q. 1990. Qualitative evaluation and research methods. Thousand Oaks, CA: SAGE Publications.

Pelders, J. & Nelson, G. 2019. Living conditions of mine workers from eight mines in South Africa. Development Southern Africa, 36(3): 265-282.

Piyapong, J. & Tsunemi, W. 2014. Perception for risk management in contaminated sites. International Journal of Environmental Research and Public Health, 11(6): 6291-6313. www.mdpi.com/journal/ijerph [Accessed on 2 September 2017].

Polit, D.F. & Beck, C.T.2010. Generalisation in quantitative and qualitative research: Myths and strategies. International Journal of Nursing Studies, 47(11): 1451-1458.

Plaut, M. & Holden, P. 2012. Who rules South Africa? Pulling the strings in the battle for power. Jonathan Ball Publishers.

Pretty, M.M. & Odeku, K.O. 2017. Harmful mining activities, environmental impacts, and effects in the mining communities in South Africa: A critical perspective. Environmental Economics, 8 (4): 14-24.

Rabe, M.E. 2006. Black mineworkers' conceptualisations of fatherhood: A sociological exploration in the South African gold mining industry. Unpublished PhD thesis, University of South Africa, Pretoria. http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2007-99211-266&lang=es&site=ehost-live.

Renn, O. 2008. Risk governance: Coping with uncertainty in a complex world. London: Earthscan.

Ripley, E.A. and Redmann, R.E. 1995. Environmental effects of mining. Boca Raton, FL: CRC Press.

Ritchie, J., Lewis, J., & Elam, R.G. 2013. Selecting samples. In Ritchie, J. & Lewis, J. Qualitative research practice: A guide for social science students and researchers. London: Sage.

Robson, C. 2002. Real world research: A resource for social scientists and practitioner-researchers. Oxford: Blackwell.

Rogerson, R.J. 1995. Environmental and health-related quality of life: Conceptual and methodological similarities. Social Science & Medicine, 41(10): 1373-1382.

Rousseau, D.M., Manning, J., & Denyer, D. 2008. Evidence in management and organisational science: Assembling the field's full weight of scientific knowledge through syntheses. Academy of Management Annals, 2(1): 475–515.

Sadler, B. & Dalal-Clayton, D.B. 2012. Strategic environmental assessment: A sourcebook and reference guide to international experience. London: Earthscan.

Sánchez, L.E. & Hacking, T. 2002. An approach to linking environmental impact assessment and environmental management systems. Impact Assessment and Project Appraisal, 20(1): 25–38.

Satterthwaite, D. 2003. The links between poverty and the environment in urban areas of Africa, Asia, and Latin America. The ANNALS of the American Academy of Political and Social Science.

Saunders, M., Lewis, P., & Thornhill, A. 2007. Research methods for business students (4th ed). London: Pearson Education.

Scarpello, V. & Campbell, J.P.1983. Job satisfaction: Are all the parts there? Personnel Psychology, 36(3): 577-600.

Schurink, W., Fouché, C.B., & De Vos, A.S. 2011. Qualitative data analysis and interpretation. In De Vos, A.S., Delport, C.S.L., Fouché, C.B., & Strydom, H. (eds). 2011. Research at grass roots: For the social sciences and human service professions. Pretoria: Van Schaik Publishers: 397-423.

Schwandt, T.A., Lincoln, Y.S., & Guba, E.G. 2007. Judging interpretations: But is it rigorous? Trustworthiness and authenticity in naturalistic evaluation. New Directions for Evaluation, 114:11-25.

Shenton, A.K. 2004. Strategies for ensuring trustworthiness in qualitative research projects. Education for information, 22(2): 63-75.

Sheridan, V. & Storch, K. 2009. Linking the intercultural and grounded theory: Methodological issues in migration research. Qualitative Social Research, 10(1): 12-28.

Sherraden, M.S. 2001. Service and the human enterprise (perspective). St. Louis: Washington University, Centre for Social Development.

Slovic, P. 1987. Perception of risk. Science, 236(4799): 280–285.

Spradley, J. 1979. Asking descriptive questions. The Ethnographic Interview, 1: 44-61.

Stewart, P., Bezuidenhout, A., & Bischoff, C.2020. Safety and health before and after Marikana: subcontracting, illegal mining and trade union rivalry in the South African mining industry. Review of African Political Economy, 47(163): 27-44.

Strydom, P. 2002. Risk, environment, and society: Ongoing debates, current issues, and future prospects. Buckingham: Open University Press.

Sukhdev, P. 2008. The economics of ecosystems & biodiversity: An interim report. Brussels: European Union Commission for the Environment.

Tashakkori, A., Teddlie, C., & Teddlie, C.B.1998. Mixed methodology: Combining qualitative and quantitative approaches. Thousand Oaks, CA: Sage.

Tempelhoff, E. 2010. Mine could destroy Mapungubwe. News24, May 12. http://www.news24.com/SouthAfrica/News/Mine-could-destroy-Mapungubwe20100511 [Accessed June 20 2018].

Terre Blanche, M. & Durrheim, K. 1999. Histories of the present: Social science research in context. In Terre Blanche, M., Durrheim, K., & Painter, D. (eds). 2006. Research in practice: Applied methods for the social sciences. Cape Town: Juta and Company Ltd: 1-17.

Terre Blanche, M. & Durrheim, K. 1999. Social constructionist methods. In Terre Blanche, M., Durrheim, K., & Painter, D. (eds). 2006. Research in practice: Applied methods for the social sciences. Cape Town: Juta and Company Ltd: 147-172.

Tonn, B., English, M., & Travis, C. 2000. A framework for understanding and improving environmental decision making. Journal of Environmental Planning and Management, 43(2): 163-183.

Tsang, E.W.K. & Kwan, K. 1999. Replication and theory development in organisational science: A critical realist perspective. Academy of Management Review, 24(4): 759-780.

Viljoen, S. 2007. An analysis of some environmental law provisions and alternative governance approaches for the promotion of corporate social responsibility in South Africa. Unpublished PhD thesis, North-West University, Potchefstroom.

Von Kotze, A. 1999. A new concept of risk. In Holloway, A. (ed). Risk, sustainable development, and disasters: Southern perspectives. Cape Town: Periperi Publications: 33-40.

Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. 2013. The risk perception paradox: Implications for governance and communication of natural hazards. Risk Analysis, 33(6): 1049–1065.

Wahyuni, D. 2012. The research design maze: Understanding paradigms, cases, methods, and methodologies. Journal of Applied Management Accounting Research, 10(1): 69-80.

Walker, C. & Baxter, J. 2019. Method sequence and dominance in mixed methods research: A case study of the social acceptance of wind energy literature. International Journal of Qualitative Methods, 18.

Walle, A.H. 1996. Tourism and the Internet: Opportunities for direct marketing. Journal of Travel Research, 35(1): 72-77.

Watts, M.J. & Bohle, H.G. 1993. The space of vulnerability: The causal structure of hunger and famine. Progress in Human Geography, 17(1): 43–67. http://journals.sagepub.com/doi/10.1177/030913259301700103.

Wilson, F. 1972. Migrant labour. Johannesburg: South African Council of Churches and Spro-Cas.

Watts, M.J. & Bohle, H.G.1993. The space of vulnerability: The causal structure of hunger and famine. Progress in Human Geography, 17(1): 43-67.

Welman, J.C. & Kruger, S.J. 2001. Research methodology for the business & administrative sciences. Cape Town: Oxford University Press.

Williams, C. 2007. Research methods. Journal of Business & Economic Research, 5(3): 65-72.

Wilson, F. 2011. Labour in the South African gold mines 1911-1969. Cambridge: Cambridge University Press.

Wisner, B., Gaillard, J.C. and Kelman, I. (eds). 2012. Handbook of hazards and disaster risk reduction. London: Routledge.

Xu, G., Feng, X., Li, Y., Chen, X., & Jia, J. 2017. Environmental risk perception and its influence on well-being. Chinese Management Studies, 11(1): 35-50.

Yin, R.K. 2003. Case study research: design and methods. (3rd ed). Thousand Oaks, CA: Sage.

INTERVIEWS WITH MEMBERS OF THE MANANAGEMENT OF WBSH (PTY) LTD

Opinions expressed in this thesis and the conclusions arrived at are those of the author, and, owing to nature of this research and the ethical standards that apply concerning confidentiality, the names of individual participants have been withheld.

References of interviewees

Reference number & date	Subject of interview
TPMMW_ 1.2019.	Measures implemented at present to mitigate environmental risk at the WBSH mine
TPMMW_ 2.2019	Measures implemented at present to mitigate environmental risk at the WBSH mine
TPMMW_ 3.2019	Measures implemented at present to mitigate environmental risk at the WBSH mine
TPMMW_ 4.2019	Measures implemented at present to mitigate environmental risk at the WBSH mine
TPMMW_ 5.2019	Measures implemented at present to mitigate environmental risk at the WBSH mine

****TPMMW** denotes top management mineworker*

****1** denotes the number of top management mineworker*

****** 2019** denotes the year of interview*

INTERVIEWS WITH GENERAL MINEWORKERS AT THE WBSH MINE

References of interviewees

Reference number & date	Subject of Interview
GMW_ 1.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_ 2.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_ 3.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_4.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_5.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_6,2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_7.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_8.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_9.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_10.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_11.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW 12.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_13.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_14.2019	Perceptions of mineworkers of the risk to which their work exposes them
GMW_15.2019	Perceptions of mineworkers of the risk to which their work exposes them

** **GMW** denotes general mineworker*

*** **1** denotes the number of each mineworker*

**** **2019** denotes year of interview*

LIST OF APPENDICES

APPENDIX A: Interview questions for members of the management of WBSH (Pty) Ltd

SEMI-STRUCTURED INTERVIEW QUESTION SHEET

Preamble

My name is Hilma Shaanika, a student at the Cape Peninsula University of Technology (211181684). I am completing a Master's degree in Environmental Management. I am conducting a research study that is titled **"PERCEPTIONS OF MINEWORKERS OF ENVIRONMENTAL RISK IN THE MINING SECTOR: A CASE STUDY OF THE WALVIS BAY SALT HOLDINGS MINE IN NAMIBIA."** The purpose of this study is to gather information concerning this research topic. It is purely an academic exercise and any information that is provided will be treated as strictly confidential and participants will also remain anonymous.

For any assistance, questions or queries please use the contact details given below:

Cell number: +264 81 640 7166

E-mail address: hilma.kaunacky@gmail.com

SECTION A; INTERVIEW SCHEDULE FOR MANAGEMENT OF WALVIS BAY SALTHOLDINGS MINE

A. Personal information of interviewee

- Gender: Male: [ ] Female [ ]
- Position held……..
- When did you start working here……?

Management perception of the environmental risk of mining operations

Environmental safety concerns and interventions by the management:

1. What are the activities of the mining operations of this plant?
   a. ……...
   b. ……..
   c. ……...
2. Which of these activities results in environmental concerns or have adverse consequences for the environment?
3. What quantities of waste materials are generated by the mining operations? What is the composition of the waste?

4. Have any environmental or safety concerns been reported to your office by any employees?
5. Do you take your employees to hospital for regular medical check-ups?
6. Do you think that mines should take care of the environments in which they operate?
7. What is your understanding of the risks that working in the mine could cause to employees?
8. What proactive strategies are you using to reduce workplace injuries and fatalities in your organisation?
9. Do you provide safety materials? If yes, please what are the materials issued?
10. Does Walvis Bay Salt Holdings have an environmental policy or guidelines?
11. What are the necessary steps that you are taking as management to abide to the company's environmental risk policy and guidelines?
12. What are the principal obstacles that the company encounters in the implementation of its environmental risk policy and guidelines?
13. Does your company provide any training to its employees concerning the management of environmental risk management? If so, what kind of training?

Economic conditions

14. Do you provide medical cover as a part of the salaries of your employees?
15. If yes, do you think that it's enough to cover their medical requirements?
16. Which of the economic implications of environmental risk are of most concern to your company?
17. Please explain your opinions concerning integrating environmental guidelines with management practices in your business practices at Walvis Bay Salt Holdings.

Other

18. Do you have any suggestions for increasing the ability of Walvis Bay Salt Holdings to reduce environmental risk?

THANK YOU

APPENDIX B: Interview questions for general mineworkers at the WBSH mine

Preamble

My name is Hilma Shaanika, a student at the Cape Peninsula University of Technology (211181684). I am completing a Master's degree in Environmental Management. I am conducting a research study that is titled **"Perceptions of mineworkers of environmental risk in the mining sector: A case study of the Walvis Bay Salt Holdings mine in Namibia."** The purpose of this study is to gather information concerning this research topic. It is purely an academic exercise and any information that is provided will be treated as strictly confidential and participants will also remain anonymous.

For any assistance, questions, or queries, please use the contact details given below:

Cell number: +264 81 640 7166

E-mail address: hilma.kaunacky@gmail.com

SECTION A; INTERVIEW SCHEDULE FOR GENERAL MINEWORKERS AT THE WALVIS BAY SALT HOLDINGS MINE

A. Personal information of interviewee

- Gender: Male [ ] Female [ ]
- Position held……...
- When did you start working here?
- Where do you live?

SECTION B: Perceptions of general mineworkers of the risk that mining operations entail

Safety concerns and possible interventions:

1. What are your daily duties?
2. Which harmful materials do you come into contact with in your daily duties?
3. What sort of clothing or equipment do you use to protect you against these materials?
4. What are the hazards to which you are exposed in your work?
5. In general, do you feel safe at work? If no, why do you feel unsafe?
6. How could what you describe be changed?
7. Where do you live?
8. How long have you been working at the Walvis Bay Salt Holdings mine?

9. Please check the table below to indicate how often you are exposed to each type of risk.

Source of Risk	Never	Daily	Weekly	Monthly
Noise pollution	**X**			
Air pollution		**X**		
Land pollution			**X**	
Water pollution		**X**		
Waste pollution			**X**	

1. Do you belong to an organisation that fights to protect your rights against exposure to risks?
2. Have you been injured before? If yes, what happened? How was it taken care of? Who was responsible?
3. Do you believe that safety clothing and equipment materials could help to protect you from injuries?
4. Are you provided with protective clothing and equipment?
5. Do you have belonged to organisation for workers or union that will act upon your complaints concerning exposure to risk at the workplace?
6. If so, what are its roles and functions?
7. Which environmental policies and practices has your company adopted?
8. Have you ever received training in the management of environmental risk? If yes, what kind of training did you receive?
9. Why do you think you were given training in managing environmental risk?
10. What are your roles and responsibilities in relation to reducing environmental risk in your company?

Socioeconomic conditions

1. What is you level of education?
2. Is anyone else in your family employed?
3. How many people in your family are employed?
4. How many children are there in your family?

Other

5. What do you think needs to be changed or introduced to increase the effectiveness of the implementation of the company environmental policy?

6. Do you have any suggestions for reducing environmental risk at the Walvis Bay Salt Holdings mine?
7. Is there anything else you would like to add that has not been covered so far, in relation to your health, safety, training, and unionisation?

THANK YOU

APPENDIX C: Interview questions for laboratory coordinators

My name is Hilma Shaanika a student at the Cape Peninsula University of Technology (211181684) doing a master's degree in Environmental Management at Cape Peninsula University of Technology. I am conducting a research entitled **"Perception of mineworkers towards environmental risk in the mining sector, a case study of Walvis Bay Salt Holdings mine in Namibia."** The purpose of this study is to gather information on the above subject matter. This is purely an academic exercise and any information provided will be accorded confidential treatment. The study will also remain anonymous in its treatment of its participants.

For any assistance, questions or queries please use the contact details given below:

Cell number: +264 81 640 7166

E-mail address: hilma.kaunacky@gmail.com

SECTION B; INTERVIEW SCHEDULE FOR MANAGEMENT OF WALVIS BAY SALT HOLDINGS MINE

B. Personal information of interviewee

- Gender: Male: [ ] Female [ ]
- Job Position……..
- When did you start working here……?

C. Management perception of the environmental risk of mining operations

Environmental safety concerns and Management intervention:

19. What are the activities constituting mining operation in this pant?
    a. ……...
    b. ……..
    c. ……...
20. Of these activities which induces environmental concerns or have environmental challenges?
21. How much waste materials are generated by the mining operations? Also, in terms of waste composition.
22. Is there any environmental or safety concerns that have been reported by any employees to your office?
23. Do you take your employee to hospital for regular medical check-ups?

24. Do you think mines should care for the environment where they operate?
25. What is your understanding when working in the mine could cause environmental risk to employee?
26. What proactive strategies are you using to reduce workplace injuries and fatalities in your organization?
27. Do you give safety materials? If yes please what are the materials issued?
28. Does Walvis Bay Salt Holdings have an environmental policy or guidelines?
29. What are the necessary steps that you are taking as management to abide to the company's environmental risk policy and guideline?
30. What are the challenges the company encounter in the implementation of the company environmental risk policy and guidelines?
31. Does your company provide any training to its employees about environmental risk management? If so what kind of training?

Economic conditions

32. Do you provide medical cover as part of your employee's salary?
33. If yes to the above, do you think it's enough to cover their medical requirements?
34. Which key economic issues relating to environmental risk are of most concern to your company?
35. Please share your views pertaining integrating environmental guidelines management practices in your business processes at Walvis Bay Salt Holdings?

Other

36. What are your other recommendations regarding reducing environmental risks by Walvis Bay Salt Holdings?

THANK YOU

APPENDIX D: Letter from the supervisor of the researcher to request permission to conduct

Cape Peninsula University of Technology

Faculty of Applied Sciences
Environmental and Occupational Studies
District 6 Campus
Date:12 March 2019

Dear Sir /Madam

Re: Application for Informant's Consent

With reference to the above, I would like to confirm that Ms Hilma Shaanika is registered for Masters in Environmental Management at the Cape Peninsula University of Technology in the Department of Environmental and Occupational Studies. She is currently busy with the research titled: *Perceptions of mining workers towards environmental risk in the mining sector. A case study of Walvis Bay Salt Holdings Mine, Namibia.* The crucial aspect of this research requires her to request the Office of the SHERQ Manager to share information regarding perception of mine workers towards environmental risk.

In view of the above, we support her research and further request that Walvis Bay Salt Holdings assist her with a letter granting her permission to conduct the study as stipulated by the research ethical committee (HDC) of the University. Her research project is Field work and requires a combination of Qualitative and Quantitative research methods. She will conduct interviews with management, the Department of Environment, and the Department of health and safety, the representative and health and safety officers and Union workers.

Should you require any further details of confirmation regarding the authenticity of the above information, you are most welcome to contact us through the contact details listed below. Your assistance will be very much appreciated.

Yours Faithfully

Dr V Zungu
Tel: +27 21 460 3178
Email: ZunguV@cput.ac.za

DEPARTMENT OF ENVIRONMENTAL & OCCUPATIONAL STUDIES
12 MAR 2019
Cape Peninsula University of Technology

PO Box 1906 Bellville 7535 South Africa
086 123 2788

APPENDIX E: Ethical clearance certificate

P.O. Box 1906 · Bellville 7535 South Africa ·Tel: +27 21 953 8677 (Bellville), +27 21 460 4213 (Cape Town)

Ethics Approval Letter **Reference no: 211181684/04/2020**

Office of the Chairperson **Research Ethics Committee**	**Faculty of Applied Sciences**

On 27 April 2020, the Faculty Research Ethics Committee of the Faculty of Applied Sciences granted ethics approval to Shaanika, H.K. for research activities related to a project to be undertaken for a degree (M Tech: Environmental Management) at the Cape Peninsula University of Technology.

Title of project:	Perceptions of mine workers towards environmental risk in the mining sector in Walvis Bay, Namibia

Comments (Add any further comments deemed necessary, e.g. permission required)

1. Human subjects are included in the proposed study.
2. This permission is granted for the duration of the study.
3. Research activities are restricted to those detailed in the research proposal.
4. The research team must comply with conditions outlined in AppSci/ASFREC/2015/1.1 v1, CODE OF ETHICS, ETHICAL VALUES AND GUIDELINES FOR RESEARCHERS.

Signed: Chairperson: Research Ethics Committee	27/04/2020 **Date**

APPENDIX F: Ethical clearance form

Cape Peninsula University of Technology

Statement of Permission

Data/Sample collection permission is required for this study.

Reference no.	211181684/04/2020
Surname & name	Shaanika, H.K.
Student Number	211181684
Degree	M Tech: Environmental Management
Title	Perceptions of mine workers towards environmental risk in the mining sector in Walvis Bay, Namibia
Supervisor(s)	DR VINCENT MDUDUZI ZUNGU
FRC Signature	
Date	2020 April 27

APPENDIX G: Letter from WBSH (Pty) Ltd granting permission to conduct the study

WALVIS BAY SALT HOLDINGS

Date: 22 March 2019

To Whom It May Concern

Re: Permission to Do Research

This letter serves to confirm that Hilma Shaanika has been granted permission to conduct a research at Walvis Bay Salt Refiners as part of her academic fulfillment. Her Topic is titled: **Perception of mining workers towards environmental risk in the mining sector, a case study of Walvis Bay Holdings, Namibia**

Yours Faithfully

Remigius Angula
(Quality and Food Safety Coordinator)

WAI-VIS BAY SALT
REFINERS (PTY)LTD
Co. Reg No: 83/06611/07
VAT Reg No: 0056618-01-5
P.O.Box 2471, Walvis Bay
Tel: 213350 Fax: 209635

APPENDIX H: Letter from the Mineworkers Union of Namibia granting permission to conduct the study

MINEWORKERS UNION OF NAMIBIA

P.O. Box 240
ARANDIS
NAMIBIA
Erf 2011 OSTRICH STREET, ARANDIS

Tel: +264 64 510 065
Fax: +264 64 510 031
E-mail: munwest@mweb.com.na
website: mun-na.com

M.U.N.

WESTERN REGIONAL OFFICE

DATE 24 May 2019 No. of Pages: 1

ATTENTION To whom it may Concern

MEMORUNDUM OF CONSENT

This letter herewith affirms that Ms Hilma Shaanika has been granted consent by the Western Regional office of the Mineworkers Union of Namibia to conduct her study research, which will include but not limited to face to face interviews with employees and stakeholders in the mining and energy sectors in the Erongo Region.

Having ascertained that the information recorded pursuant to this exercise will solely be utilised for academic purposes It Is our hope that you will render all the necessary assistance and support in this respect.

We trust the above to satisfactory and do not hesitate to contact the author hereof may you reserve any uncertainty.

Yours Sincerely

For Mineworkers Union of Namibia (MUN)

Mineworkers Union of Namibia (M.U.N.)

Filleppus George Ampweya
Western Regional Organizer / Coordinator
CELL: 0812066869 |TELL: 064510065 |FAX: 064510037
P O Box 240, Arandis
www.mun-na.com
ampweyageorge@gmail.com | munwest@mweb.com.na

APPENDIX I: Editorial letter

The Editor Editorial Services
(043) 726-4829 gailfrank@nahoonreef.co.za

18 - 01 - 2022

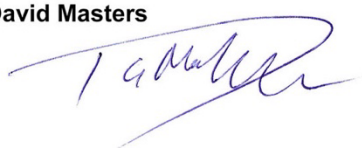
TO WHOM IT MAY CONCERN

This is to certify that the thesis titled "PERCEPTIONS OF MINEWORKERS OF ENVIRONMENTAL RISKS IN THE MINING SECTOR: A CASE STUDY OF THE WALVIS BAY SALTH HOLDINGS (WBSH) MINE IN NAMIBIA" by Hilma Kaunapawa Shaanika has been edited by David Masters.

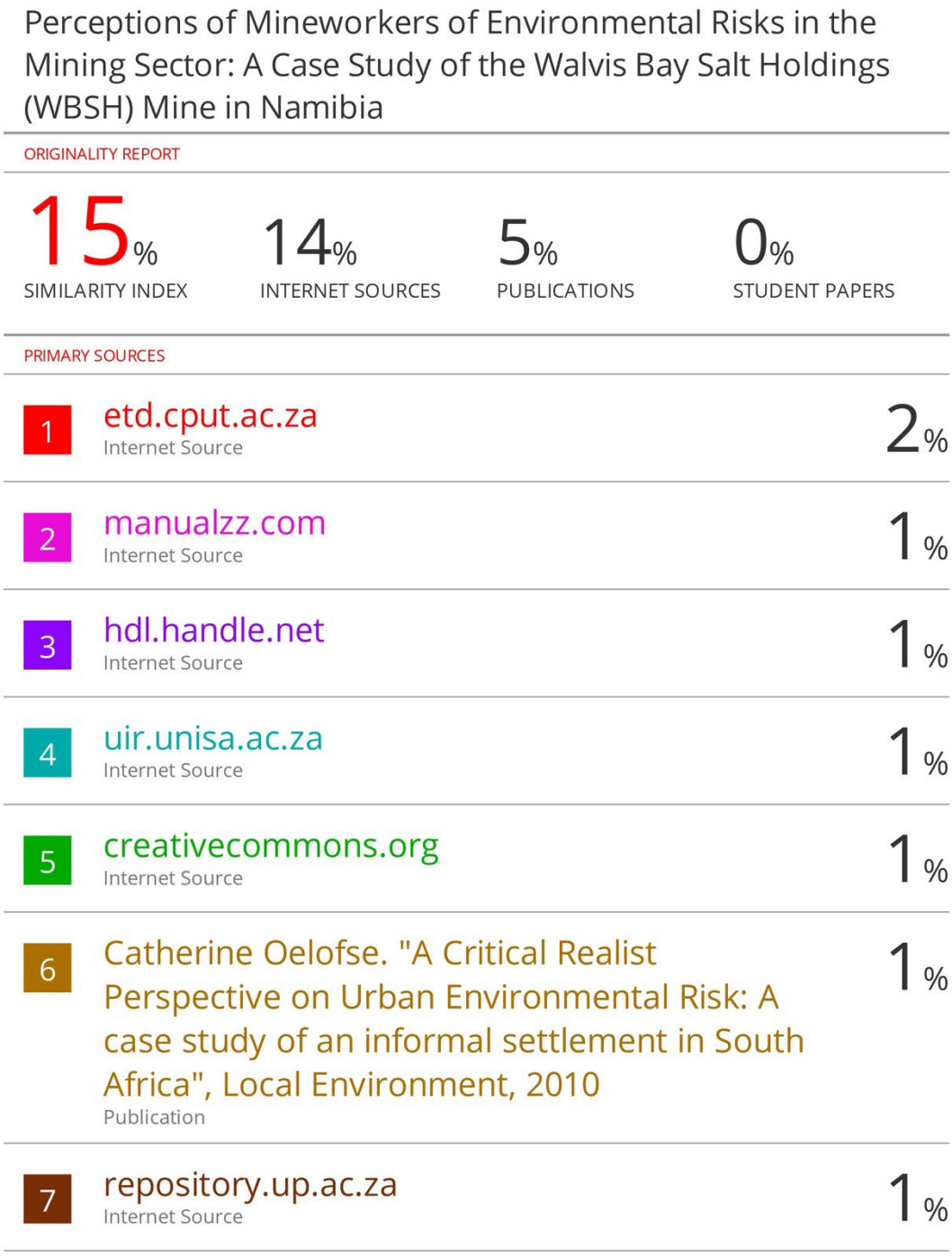
Although I have not contributed to the content of the text, a great deal of rephrasing has been required, to give the writing the precision and formal tone that should characterise an academic document. As all changes have been made at my discretion, any discussion concerning the suitability of the phrasing should be referred to me and not the candidate.

Should anyone wish to discuss or clarify any points of grammar, I may be contacted by e-mail at gailfrank@nahoonreef.co.za and my telephone number at home is (043) 726 4829

Yours sincerely,
David Masters



APPENDIX I: Turnitin report



Perceptions of Mineworkers of Environmental Risks in the Mining Sector: A Case Study of the Walvis Bay Salt Holdings (WBSH) Mine in Namibia

ORIGINALITY REPORT

15%	14%	5%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	etd.cput.ac.za Internet Source	2%
2	manualzz.com Internet Source	1%
3	hdl.handle.net Internet Source	1%
4	uir.unisa.ac.za Internet Source	1%
5	creativecommons.org Internet Source	1%
6	Catherine Oelofse. "A Critical Realist Perspective on Urban Environmental Risk: A case study of an informal settlement in South Africa", Local Environment, 2010 Publication	1%
7	repository.up.ac.za Internet Source	1%

8	www.wbsalt.co.za Internet Source	<1 %
9	libdspace.ufh.ac.za Internet Source	<1 %
10	core.ac.uk Internet Source	<1 %
11	citeseerx.ist.psu.edu Internet Source	<1 %
12	dspace.nwu.ac.za Internet Source	<1 %
13	researchspace.ukzn.ac.za Internet Source	<1 %
14	vital.seals.ac.za:8080 Internet Source	<1 %
15	www.chamberofmines.org.na Internet Source	<1 %
16	repository.nwu.ac.za Internet Source	<1 %
17	docplayer.net Internet Source	<1 %
18	www.iisd.org Internet Source	<1 %
19	drop.sun.ac.za Internet Source	<1 %