



**Hazard Assessment and Disaster Preparedness  
towards Sustainable Development in  
Mpumalanga (South Africa) Coal-Mining Areas**

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## Abstract

Mining and mining-related activities remain the world's most intensive, primary industrial activity undertaken with severe environmental impact. Coal mining falls within these primary undertakings, while coal burning for energy use further adds to environmental degradation. Coal burning is by far the least expensive and thus the most affordable means of energy supply to the South Africa low-income communities. It is likely that this status quo will continue indefinitely. The use of coal as an energy source in South African communities has been inherited with its resultant environmental (physical), social and economic implications. The physical implications are the actual hazards associated with coal during and after mining activities. "Physical hazards" include processes generating coal dust, coal ash and gaseous emissions, and hazards that manifest themselves from the existence of coal mining at a particular site, such as spontaneous combustion, surface instability and acid mine-water drainage. "Social hazards" are mostly the social and economic effects that are related to health. Social hazards associated with coal mining, coal processing and coal usage include dilution of cultural values, ethics, norms and the growth of informal sectors, for example, settlements and trade. Some of these hazards are immediate, while others are long-term and cumulative. Emphasis was placed on the cumulative effects of mining activities and the need to address issues relating to communities that live close to mining operations. This process of addressing community concerns is known as "creating a sustainable mining community". South Africa hosted the 2002 World Summit on Sustainable Development and is a signatory of the working plan of action known as the Johannesburg Plan of Implementation. Therefore, one would expect to see that mining communities in South Africa are acting on and benefiting from this plan of action.

The aim of this research is to assess the effectiveness of the 2002 World Summit on Sustainable Development and the Johannesburg Plan of Implementation in promoting sustainable mining and sustainable communities through changes in practices, perceptions and community participation in decision making. The research, undertaken during February to June 2007, examines the role of stakeholders and local authorities in basic environmental decisions. Environmental decisions examined were the provision of education and information to the community, uplifting community welfare through



corporate social investment and corporate social responsibility. The surrounding communities of eMalahleni (formerly Witbank) in the Mpumalanga (Highveld) coal-mining region – were identified as a suitable area for this case study.

Social research tools, comprising multiple-choice and open-ended questions administered to 6 790 respondents (3 930 learners and 2 860 general adult population), 650 voluntary comments, six individual interviews, and a 20 member focus group discussion, were used. Photographic images and personal observation provided meaning to results by presenting the quantitative and qualitative data visually. A blended methodological approach was used to analyse the data using descriptive statistics and a t-test for variance. Tables, bar graphs and pie charts were the various representative techniques deployed during the analysis. Data were analysed comparing statistical input and responses of the learners and the general population.

Results presented show that the studied community is aware of some hazards associated with coal from the mining process to indoor combustion. The community studied is aware of the need for pro-active measures to protect their community. Members of the community are not aware of company decisions affecting the community with regard to coal hazards. They are also unaware of the existence and application of environmental legislation. Awareness was not linked to education or information obtained from a reliable source, such as a mining company or a local authority. It was based on personal experience, longevity of dwelling in the community and observation of the health conditions of relatives and friends.

Some voluntary comments from the respondents and photographic images are included to support the community's outlook. The research concluded that there are more unidentified hazards in the community than were covered in the structured questionnaires. The responses received to the questionnaires exposed the mining industry as being dismissive when it came to applying the law. This evasive behaviour emanates from the laxity of the enforcement departments and responsible authorities. More needs to be done to attain the requirements of the Johannesburg Plan of Implementation as agreed upon at the 2002 World Summit on Sustainable Development.



*This PhD thesis is dedicated to my grand mum,  
**Ma TABI-MBU,**  
who passed away on the 24<sup>th</sup> November 1985.*





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## Abbreviations, Acronyms and Glossary

Aids	Acquired Immune Deficiency Syndrome
APELL	Awareness and Preparedness for Emergencies at a Local Level
BEE	Black Economic Empowerment
C/CO/CO <sub>2</sub>	Carbon, carbon monoxide and carbon dioxide are used interchangeably by the respondents who completed the questionnaires as their level of education did not enable them to distinguish between the solid (carbon) and the gases (carbon monoxide and carbon dioxide)
CIAB	Coal Industry Advisory Board
CNN	Cable Network News
CoM	Chamber of Mines (of South Africa)
DEAT	Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DWAF	Department of Water Affairs and Forestry
EAMIMOIM	European Association for Mining Industries, Metal Ores and Industrial Minerals
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EMPR	Environmental Management Programme Report
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GG	Government Gazette
HDI	Human Development Index
HIV	Human Immune-deficiency Virus
HMSPF	Hazard Mitigation Strategies for Project Formulation
HRO	Human Rights Organisation
HSHRS	Health and Safety Human Resource Services
ICG	International Coal Group
ICME	International Council on Metals and the Environment
ICMM	International Council of Minerals and Metals
IDNDR	International Decade of Natural Disaster Reduction





IFRCRC	International Federation of Red Cross and Red Crescent Societies
IMF	International Monetary Fund
IRIN	Integrated Regional Information Networks, which is the humanitarian news and analysis service of the UN Office for the Coordination of Humanitarian Affairs
ISO	International Standards Organisation
JD	Johannesburg Declaration
JDSD	Johannesburg Declaration on Sustainable Development
JPOI	Johannesburg Plan of Implementation
MAC	Mines and Communities
MHSC	Mine Health and Safety Council
MSHA	Mine Safety and Health Administration (of the United States of America)
MSNBC	Microsoft News Broadcasting Corporation (a news website that is a joint venture by NBC Universal and Microsoft)
NIHL	Noise-Induced Hearing Loss
OSH	Occupational Safety and Health
PEMA	Physical Environmental Management Accounting
PGM(s)	Platinum Group Metal(s)
SAIT	Site-assistance Inspection Tool
SAMISTR	South African Mining Industry Sustainable and Transformation Report
SAMRASS	South African Mines Reportable Accident Statistical System
SAPP	Southern African Power Pool
SD&M	Synonyms, Definitions and Meanings (about the Sago mine disaster)
SDA	Sustainable Development in Action
SDM	Sustainable Development through Mining
SDR	Sustainable Development Report
SE	Sustainable Entrepreneurship
SIAT	Site Inspection Assistance Tool
SIS	Safety Information Site
SME	Small and Medium Enterprise
UN	United Nations
UNCED	United Nations Conference on Environment and Development



UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environmental Programme
UNESC	United Nations Economic and Social Council
UNSD	United Nations Sustainable Development
USA	United States of America
USDL	United States Department of Labor
WBCSD	World Business Council for Sustainable Development
WCI	World Coal Institute
WEC	World Energy Council
WSSD	World Summit on Sustainable Development
WVG	West Virginia Gazette





## Chapter 1: MAIN INTRODUCTION AND BACKGROUND

*Human beings are at the centre of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature.*

*Principle 1, Rio Declaration 1992 (Rolston 1992:1).*

### 1.1 Sustainability in the 21<sup>st</sup> Century – World Summit on Sustainable Development

Principle 1 of the United Nations Conference on Environment and Development (UNCED), also known as the *Rio Declaration of 1992 (Agenda 21 – An Agenda for Sustainability in the 21<sup>st</sup> Century)* (UNCED 1992), seems to espouse a romantic view of *humans* living in harmony with nature. In reality, events of the 1990s proved contrary to the romantic view of *man* living in harmony with nature (Boulle 1990). In fact *man* has not lived in harmony with nature: there are increasing disasters caused by environmental degradation or extreme natural hazards (Horowitz 2001; Hogan & Marandola 2007). It is argued further by Nimpuno (2001) that traditional societies were able to live in harmony with nature, but the introduction of technologies has altered many natural processes. Subsequent to 1992, despite a broad range of international and local interventions to promote *sustainability* under the auspices of the Rio Declaration (IFRCRCS 2009; GFDRR n.d.), evidence shows that environmental degradation around the world has continued to increase rather than decrease (Lewin 2004; Jorgenson 2004). One such international initiative was the International Decade of Natural Disaster Reduction (IDNDR) 1990-2000 (Housner 1989). The IDNDR was initiated by the United Nations (UN)

...in the face of the escalating human loss of life in developing countries, huge economic losses in developed countries and the growing possibility of mega-disasters due to population concentration (Brimicombe 2003:86).

The IDNDR lays down structures to prevent and reduce risk in various areas, including mining risk and risk in mining communities under the concept of sustainable development (Bernd & Angulo-Thorlund n.d.).

A decade after the Rio Summit, a follow-up summit took place in Johannesburg, South Africa: the 2002 World Summit on Sustainable Development (WSSD). During the deliberations of the WSSD, the *social dimension* of sustainability was identified as a missing element of the sustainability puzzle as articulated in Agenda 21 (*An Agenda for*



*Sustainability in the 21<sup>st</sup> Century*) from the Rio Summit (Smith 2003). The broad agreements of the WSSD were contained in the summit document, the Johannesburg Plan of Implementation (JPOI) (JDSO 2002; WSSD 2002). A key feature of the JPOI was that the social dimensions of environmentalism were to be considered equally with the physical dimensions of the environment. This new facet was captured under the concept of *integrated environmental management*.

*Sustainable development* is a broad concept that has been debated many times since it was documented by the Brundtland Report in 1987 (Agassi 1987; Brundtland 1987; Elkington 2007; SDA 2007). To provide a better understanding of the concept as applied in this thesis, “sustainable development” is used in relation to assessing and understanding mining risks, mining hazards and disasters emanating from mining activities and their effects on mining communities. This framework is conceptualised under the guiding principles of the WSSD and the JPOI of 2002.

As in Rio de Janeiro, there were a number of international bodies – such as the World Business Council for Sustainable Development (WBCSD) and the World Energy Council (WEC) – to bring the declaration into action (Najam 1999; Löfstedt 1993). In the Johannesburg Plan of Implementation (JPOI), a number of international bodies, civil societies and business institutions, and the Human Rights Organisation (HRO) pledged their commitments under the slogan ‘*human global society*’, to examine the Johannesburg Declaration (JD) as a focus to ensure people a dignified sustainable life (JD n.d.). The World Business Council for Sustainable Development (WBCSD), the World Energy Council (WEC) and the World Coal Institute (WCI) were intrinsically linked with pledges during the deliberations to the Johannesburg Declaration (Worthington & Grover 2006; Egan et al. 2004; Klee n.d.). These intrinsic commitments rekindled expectation in the mining and minerals sector by way of guideline rules and regulations to identify and address major challenges in the industry through new programmes and action plans in accordance with the European Association for Mining Industries, Metal Ores and Industrial Minerals (EAMIMOIM) (EAMIMOIM n.d.). These committed pledges inspired the starting point for this study, with an intention to investigate the effectiveness of these principles and programmes arising from the WSSD and JPOI and the subsequent improvement in sustainability practice on the South African mining industry, specifically the coal-mining industry.

Under the concept of “sustainability” as used in this thesis, Chapter 1 examines the application of major research terms, as “hazards”, “hazard assessment”, “risk”, “disaster”, “disaster preparedness”, “development and sustainability”, the “coal-mining industry”, and “environmental impact and hazards”. These research terms are analysed in the context of South African coal-mining activities, coal-mining methods, mining practice and changes in practice and perceptions after the WSSD and the JPOI, leading to the formation of a research problem statement, hypothesis, aim, objectives and scope.

## 1.2 Coal Mining in South Africa

Coal originates from the decay of organic remains of plants and the sedimentation of accumulated materials over millions of years (Ariffin 2003; Major 1996). The decomposition process occurred in anaerobic conditions in wetlands. Coal is the result of the compaction and heating of rock sediments in a series from sub-bituminous to bituminous to sub-anthracite to anthracite, the most advanced form of coal. The process of extracting coal resources is known as “mining”.

Prospecting for minerals and mining has a direct impact on the environment in different ways, at each phase and in any type of mining (Hooge 2000; MAC 2003). Three methods of coal mining are used in South Africa: surface mining, shallow underground mining and deep underground mining. Surface mining is the most common, due to the presence of coal deposits close to the surface (Strydom, Fuggle & Rabie 2009). Surface mining is divided into open-pit mining and open-cast mining (Sargent 2000). Open-pit mining is more usual due to the presence of deposits within a 60 m dip of the surface, such as the shallow South African coal seams. Shallow and deep underground mining also occur frequently and the technique used to mine in these conditions is known as ‘*room-and-pillar mining*’ (Hartman & Mutmanský 1987:633). This mining method is done by sinking a shaft through which the coal is extracted. Coal is extracted using the *board and pillar* pattern—coal is extracted in a grid pattern of tunnels (boards), leaving behind a regular pattern of pillars to support the overlying strata and prevent it from collapsing (Strydom et al. 2009). A major difference between shallow and deep underground mining is the depth of extraction. The biggest limitation is the quantity of coal that is left behind to support the roof, which subsequently ignites into underground fires, resulting in collapsed roofs (Strydom et al. 2009).



The western portion of the province of Mpumalanga, also referred to as the “Highveld”, is the centre of coal mining in South Africa, and the region on which this research is focused. This region has a long history of coal mining, producing 220 million tonnes of coal per annum and exporting 63.7 million tonnes of coal per annum (Kruger 2009). The sector is a major employer, employing ~57 000 workers in 1999 (Rogers 1999). It is also the region with massive mining impact. Being one of the most intensely mined areas in South Africa and having been mined for so long, the region manifests some of the most severe adverse social and environmental effects which make it a suitable setting for an investigation of whether the JPOI has had an influence towards attaining sustainability in mining.

### 1.2.1 *Environmental Impact of Mining*

The mining environment is diverse, with the physical environment being affected at every phase; from prospecting, extraction, beneficiation, closure and post-closure (Chan 2004; Goudie 2006; Strydom et al. 2009). The impact is divided into: (i) impact on the physical environment (Section 1.2) and (ii) impact on the social environment. The “social environment” includes community involvement in mining activities for example, labour, changes in demographics as a result of labour movement and imbalances with regard to work opportunities, and the daily household use of coal.

Mining impact increases with subsequent phases of development (Strydom et al. 2009). At the *prospecting* phase, the impact is relatively small and limited to the immediate physical environment through, for example, clearing of trees, vegetation, habitats, displacement and death of wildlife. Other disruptions include road construction, camps, pits, holes and shafts. At the *extraction* phase, the impact increases but is still limited mostly to the physical environment. This includes loss of topsoil, soil erosion, land-form changes, slope failure, landslides, cave-ins, and changes in water flow and availability patterns and water quality. In this research, “social impact”<sup>1</sup> is limited to safety, ecosystem alteration, noise, dust, water quality and quantity (Joyce & MacFarlane 2001). Environmental impact on health increases at the *beneficiation*, *closure* and *post-closure*

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<sup>1</sup> The term “social impact” is mostly used in relation to people and family relationships. It is certain that mining activities over the years have untold consequences on family structures, family outlook, community and family culture, and indigenous values and norms. These aspects fall outside the scope of this research.

phases (Joyce & MacFarlane 2001). At the *beneficiation* phase, hazards include risk of air pollution through sulphur, carbon and nitrogen compounds, toxic metal particles, gases, dust and acid deposition (which causes acid rain) (Strydom et al. 2009). Coal washing is a likely source of water pollution, air pollution and subsequent acid rain. Human and ecosystems are greatly affected by such chains of events (Strydom et al. 2009). The impact varies between mining sites, mining methods, equipment in use and type of minerals mined.

At the *closure* and *post-closure* phases, the impact of *discard coal*<sup>2</sup> is immense (Truter et al. 2007; DWAF 2008). Discard coal and other carbonaceous materials generate heat when exposed to air (oxysorption). The coal ignites once the temperature reaches a critical point of > 80 °C and can continue to burn for years (Adamski 2003; Clarke, Shonhardt & Bagster 1997). The environmental and social impact is not only limited to air pollution, heat and acid water, but also to ecosystems and human health, for example, the alteration of the surface soil will directly impact on low-level organisms such as earth worms and insects. This also depends on the magnitude of the hazard and the duration of the morphological formation of the rocks. Coal-mining activities in the Highveld region encompass these challenges from the *physical*<sup>3</sup> to the social and economic, commonly known as *socio-economic*<sup>4</sup>. Collectively, these challenges are referred to as “coal hazards”.

### 1.2.2 *Coal Hazards*

Coal hazards in South Africa are divided into physical and socio-economic (Fisher 1944). “Physical hazards” indicate the direct impact of coal on the environment, that is, the vicinity of the appropriate geological formation. This includes surface and biodiversity alterations, clearing of vegetation, exposing and removing the topsoil. Another physical

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<sup>2</sup> “Discard coal” is simply waste and unused coal disposed of during the excavation process due to its poor quality. It is sometimes referred to as “false” coal.

<sup>3</sup> “Environmental hazards” and “physical hazards” are used synonymously in this research to represent the actual surface destruction during coal mining.

<sup>4</sup> “Social” and “economic” is commonly referred to as “socio-economic” to represent any activity or actions involving humans and their society. It is known that humans cannot be separated from society. Thus, the term “socio-economic” is used in place of social and economic.



hazard associated with mining is acid mine-water drainage (acidification) and its environmental implications.

In conclusion, the abovementioned physical hazards have direct social consequences on individuals, communities, and surrounding ecosystems (Fisher 1944). The impact is long term and cyclical, thus exposing the social dilemma of coal mining to individuals and communities (Borm 1997). The social effects of coal mining on the miners and the surrounding community exposed to coal hazards may result in social problems for example, diseases and noise-induced hearing loss (NIHL). Diseases associated with coal hazards are chest pain, palpitations, cough and respiratory problems (Derickson 1998).

### 1.3 Problem Statement, Aim and Objectives

#### 1.3.1 *Rationale of Study and Problem Statement*

The WSSD and the JPOI emphasised the need for sustainable development in the 21<sup>st</sup> century (Smith 2003). During the WSSD deliberations, mining was identified as one of those global businesses with a negative environmental reputation (UNDESA 2003:46). At the end of the deliberations, resolutions were adopted on how to initiate programmes of action aimed at improving the mining sector (Cain 2002). Subsequently, these resolutions were endorsed by the World Coal Institute through the establishment of a set of guidelines for the mining industry. South Africa is a member of the World Coal Institute (WCI n.d. (a)) and, as such, is a signatory to the agreement and is expected to implement the respective action plan.

In South Africa, the government, through the Department of Minerals and Energy (DME) and mining companies agreed to commit to sustainable mining communities (DME 2007a; 2007b). Coal mining was specifically highlighted as one of those mining activities with major sustainability challenges at all levels of operations (Ogunlade & Winkler 2003). The Department of Minerals and Energy then incorporated into the South African mining regulations a set of guidelines formulated by the World Coal Institute (Kabemba & Southall 2010). Among the adopted guidelines, the following broad principles provide a framework for implementation plans:

... (a) work to increase the understanding of sustainable development within the industry and among mining communities and demonstrate leadership in implementing the principles; (b) minimise any adverse impact from its activities on the biosphere,





on the health and safety of its employees, and local communities, and (c) support by individual coal companies for community development initiatives to address local sustainability issues, providing enhanced economic and social opportunities relevant to the local scale of their operations (Kabemba & Southall 2010:65-66).

These guidelines, together with Section 100 (sub-sections *a* and *b*) of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002), indicate the involvement of mining communities in operational and intended mining projects as part of sustainable development.

This research examines policy documents formulated during the WSSD/JPOI and their outcome as adopted by the South African coal-mining industry. Company documents reviewed were the environmental impact assessment (EIA) and the social impact assessment (SIA) reports, the environmental management programme (EMP) and the environmental management programme report (EMPR). Within the environmental management programme report (EMPR), the community relationship section was closely scrutinised. In examining the abovementioned documents, the research aimed to answer the following questions:

- Are the residential communities of eMalahleni, South Africa aware of any hazards from coal exposure at home or at the workplace and any existing disaster-preparedness mechanisms?
- Are these communities informed about the guidelines of a sustainable mining community as formulated by the WSSD and the World Coal Institute?
- How do the mining companies relate to the surrounding community, in terms of corporate social responsibility partnerships?

In providing answers to these questions, the research took into consideration the level of the community's literacy; the relationship between stakeholders; poverty differentiation, and unemployment. Each of these considerations is relevant to the community's understanding on coal in broad terms and its impact on health; the ability to distinguish between the physical and social environments, and the unequal relationship between stakeholders.

Preliminary investigations conducted in the researched communities five to six years after the WSSD/JPOI indicate an unequal engagement between the State, mining companies and local communities (Nuwarinda 2007). This is evident as mining companies operating within the research area declined every request to participate in this research.

The situation seems contrary to the JPOI-approved guideline document, as local government authorities are not aware of their responsibilities within the mining environment. Even worse, the then Department of Minerals and Energy and the then Department of Environmental Affairs and Tourism (DEAT), both State agents and major stakeholders responsible for the issuing of mining licences and environmental management decisions, respectively, also declined to participate in this research. This response by the three major stakeholders (the Department of Minerals and Energy, the Department of Environmental Affairs and Tourism, and the three mining companies operating within the research area) altered the initial course of the study. An alternative approach was thus adopted, through a social science technique of using the community as the sole stakeholder in the research process and confirming data through *third-party*<sup>5</sup> responses.

### 1.3.2 *Hypothesis*

The WSSD policies and the JPOI have positively influenced environmental behaviour, practices and perceptions in the coal-mining sector, leading to more sustainable mining communities in South Africa.



### 1.3.3 *Aim and Objectives*

The aim of this research is to assess the effectiveness of the WSSD/JPOI in promoting sustainable mining and sustainable communities through changes in practice in mining areas by mining companies and local authorities post the WSSD, with respect to the management of environmental impact and environmental hazards of mining in surrounding communities, using the Mpumalanga Highveld coal-mining region as a case study. To achieve this aim, the following objectives were established and fulfilled namely:

- (i) Examination of the policy documents arising from the WSSD/JPOI with respect to environmental legal and ethical responsibilities, that is corporate social responsibility of the mining industry

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<sup>5</sup> A third-party approach is an indirect probing technique which has been used in this research to investigate the local mining industry through responses from the community. In this research approach, responses from retired and active mine workers who were off duty were considered important.

- (ii) Review of the policy documents, activities and practice adopted by the South African mineral sector post the WSSD/JPOI in relation to hazards posed by the coal-mining industry
- (iii) Evaluation of the social impact of coal-mining hazards on communities post the WSSD/JPOI and preventive measures such as health awareness, environmental awareness, information, communication and education by key stakeholders,
- (iv) Assessment of the hazard awareness and disaster-preparedness initiatives executed by mining companies and local authorities in compliance with the policies arising from the WSSD/JPOI in the interest of building sustainable mining communities in South Africa
- (v) Assessment of the levels of awareness of the community members with respect to their local environment, environmental rights and the right to information regarding the environment and
- (vi) Interpretation of the findings on the effectiveness of the WSSD/JPOI declarations in promoting sustainable mining practice with respect to the social and physical environments in order to inform future policies and actions.

#### 1.3.4 *Research Design*

This research adopted a blended approach and used social survey instruments designed for the target population. The social survey instruments included multiple-choice and open-ended questions, voluntary comments and inputs, semi-structured selective individual interviews, a focus group discussion and integrated photographic images taken during the field survey. The information obtained was analysed based on the WSSD/JPOI outcome, related to the research title. The research design and methodological approach are illustrated in the study design diagram (Figure 1).

#### 1.3.5 *Structure of the Thesis*

Chapter 1 provides an introduction and the background to the research. It includes a formulation of the research problem. The research objectives are dealt with in different chapters as illustrated in Figure 1. Objectives (i), (ii), and (iii) are dealt with in Chapter 2



and are guided by the following documents: the WSSD/JPOI outcome documents, reviewed policy documents, activities, practices adopted by the South African mineral sector post the WSSD/JPOI, relating to hazards posed by coal and an evaluation of the social impact of coal hazards on the community. Objectives (iv) and (v) are dealt with in Chapter 3 (Methodology and the Data Collection Process) and Chapter 4 (Data Analysis and Preliminary Results). Objective (vi) is dealt with in Chapter 5 (Results) in which a synthesis of the various objectives is made. Chapter 6 contains an interpretation and discussion of the results, whilst Chapter 7 presents the conclusions and recommendations. Thereafter a comprehensive list is provided of the references cited in this text, followed by Annexures 1 to 8.

#### 1.4 Delimitation of the Study Area

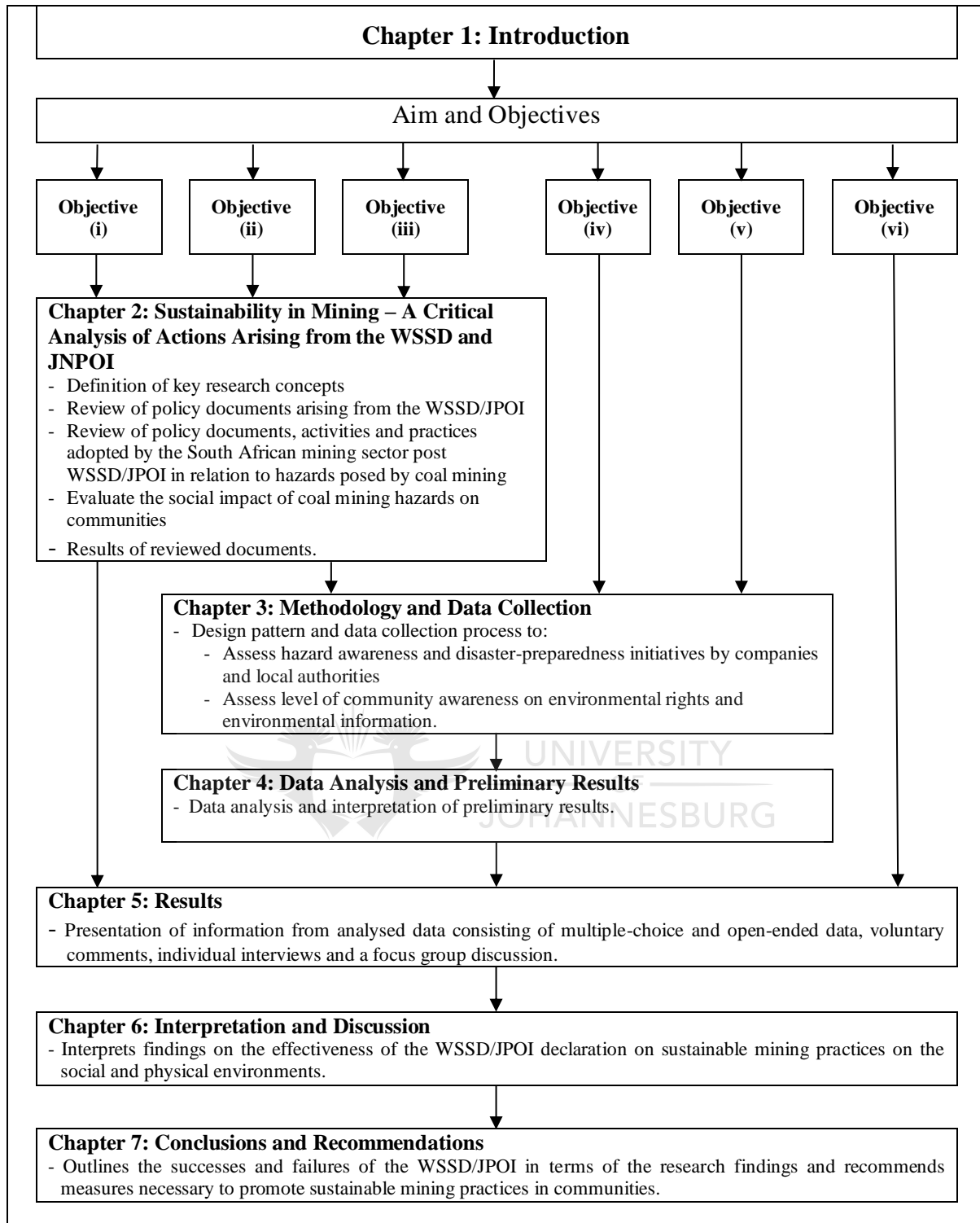
The study area is limited to the coal-mining community of eMalahleni (Highveld) in the province of Mpumalanga, South Africa (Figure 2).

The study area (Figure 3) represents a typical mining community setting in South Africa. This research community is a *black residential* area, designated by the former government prior to 1994, located at the outskirts of the town's central business district (CBD), to serve as a labour source for the industrial business district and mining sector. The nature and design of the houses are traditional and the standard and extent of the buildings is determined by income level. Some characteristics of the research community are shown in the photographic images presented in Chapter 6.

Although the study is broad in probing the understanding of coal hazards and disasters on communities, the actual research content is limited to the social impact of coal (hazards) as identified in the WSSD/JPOI guideline document on a mining community in the Highveld (Figure 3). Data obtained is analysed in a comparative study between the *learners*<sup>6</sup> and the general adult population (henceforth known as the “general population” in the area.

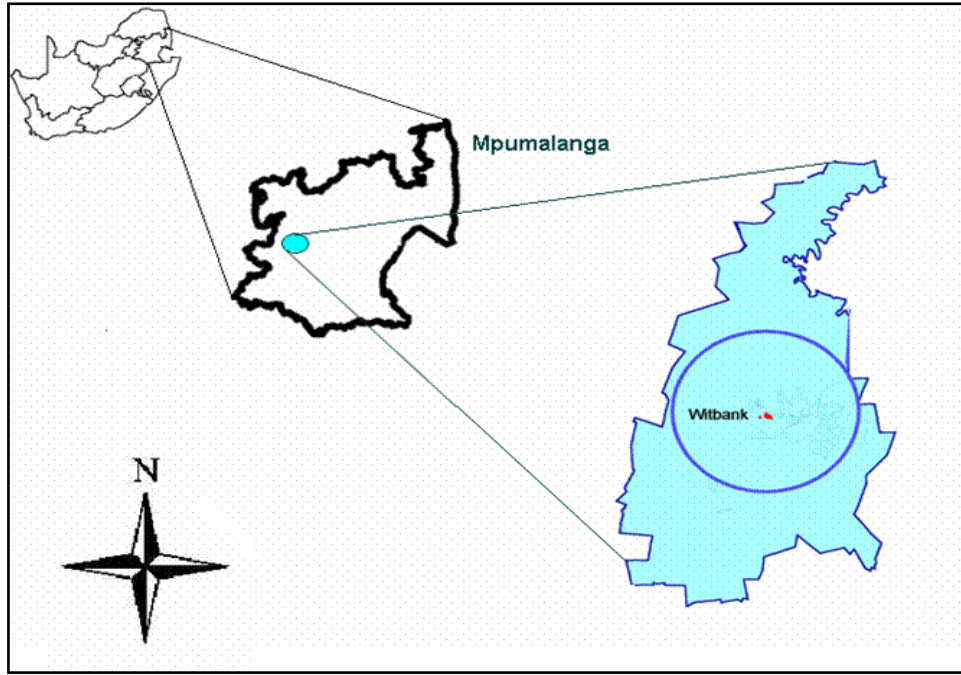
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<sup>6</sup> The South African term for a “student”. A “learner” in this research refers to any person receiving an education or obliged to receive an education in terms of the South African Schools Act (the South African Schools Act, Act No. 84 of 1996) (RSA 1996a).



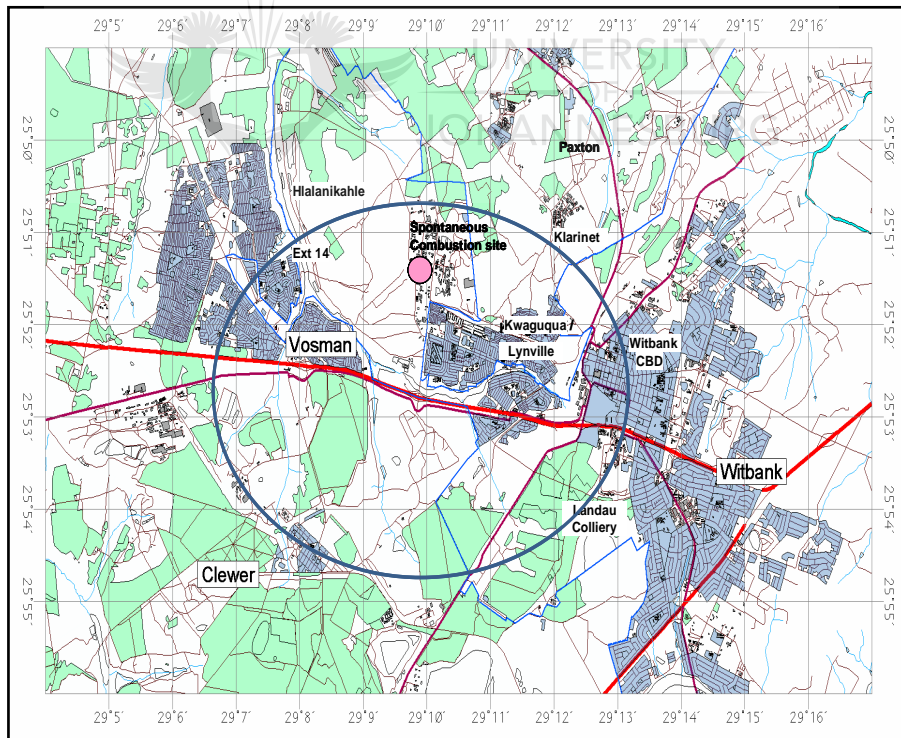
**Figure 1: Outline of research design and methodology**

The usage of key terminologies is limited as used in the context of this study on the understanding of sustainable development. These are namely: hazards, hazard assessment and risk, disaster and disaster preparedness, mining communities and the demarcated study area shown on the map of the Highveld (Figures 2 and 3).



Source: Nuwarinda (2007:21).

**Figure 2: Map showing the location of the research area (zone) located in the eMalahlani Municipality**



Source: Adapted from Nuwarinda (2007:22). Base map 2529CC Witbank 1:50 000 Topographic Mapsheet (2003). National Geo-spatial Information, Mowbray, Cape Town.

**Figure 3: Cadastral map showing research communities in relation to mining sites and industrial CBD of eMalahlani**



## 1.5 Conclusion

Chapter one gives a historic account of the principle of sustainable development, its purpose and implementation trend within the broad concept of Agenda 21. The Agenda 21 concept, has expand sustainable development practices with the identification of key indicators in Rio 1992, resulting to the Johannesburg plan of implementation (JPOI) in 2002. Through the plan of action (JPOI) 2002, the mining and energy sectors were identified as areas of concern, with Heads of Government and other stakeholders pledging effective commitment. Thereof, triggering the need to identify specific research community, as a research case study, thus outlining the research aim, objectives and a defined scope.



## **Chapter 2: Sustainability in Mining – A Critical Analysis of Actions Arising from the WSSD and JPOI**

*This chapter deals with two aspects: (i) an outline of basic definitions of terms such as hazard, hazard assessment, risk and risk management, disaster, disaster preparedness and sustainability as understood in this research in relation to sustainable development and (ii) a review of research objectives (i), (ii), and (iii) relating to the outcomes of the WSSD/JPOI and the South African plan of action adopted from the WSSD guideline document on mining (coal-mining).*

### **2.1 Fundamental principles and programmes for achieving sustainable development**

The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, outlined fundamental principles and programmes for achieving sustainable development. The Rio principles and their implementation plan became known as *Agenda 21 (An Agenda for Sustainability in the 21<sup>st</sup> Century)* (UNSD 1992). A decade after Rio, a subsequent summit was held in Johannesburg, South Africa, known as the *World Summit on Sustainable Development (WSSD)* to assess the progress and the effectiveness of Agenda 21. The key outcomes of the WSSD were captured in a summit declaration, known as the *Johannesburg Plan of Implementation (JPOI)* (UN 2002). The WSSD/JPOI contained one-hundred-and-fifty (150) clauses intended to promote sustainable development. Poverty eradication and sustainable energy (Clauses 7 and 8) were highly debated issues at the summit (UN 2002).

The task of this chapter is to: (i) examine policy documents arising from the WSSD/JPOI with respect to environmental, legal and ethical responsibilities (corporate social responsibility) of the mining industry; (ii) review policy documents, activities and practices adopted by the South African mining sector post the WSSD/JPOI, in relation to hazards posed by the coal-mining industry; and (iii) evaluate the social impact of coal-mining hazards on communities post the WSSD/JPOI and preventive measures such as health awareness, environmental awareness, information, communication and education (Section 1.3.3).



These goals will be achieved by means of a literature review of the WSSD/JPOI policy documents on mining, the World Coal Institute document on a programme and plan of action for the coal industry, presented to the WSSD, as published in a hand out entitled *Sustainable Entrepreneurship, the Way Forward for the Coal-Mining Industry* (Keay 2004; CIAB 2006). In the South African context, the following policy documents are reviewed: the Department of Minerals and Energy draft guideline document adopted from the World Coal Institute guideline and principles for the mining sector, handouts published by individual coal-mining companies on sustainable mining practice, and annual reports submitted to the South African Chamber of Mines. In reviewing the abovementioned documents, the focus is on key aspects relating to hazards, hazard assessment, risk and disaster preparedness with respect to communities surrounding coal-mining areas. In Section 2.2, these concepts are examined in the context of sustainable development and mining communities, before proceeding to the analysis of the documents.

## 2.2 Definition of Key Research Concepts

### 2.2.1 Hazard

*'A hazard is an inescapable part of life'* (Smith 1998:5). A "hazard" is defined as a naturally occurring or human-induced process with a potential to cause harm to humans, living organisms and properties (HSHRS n.d.; OSH n.d.; Smith 1998). A hazard is viewed as a *'...general source of danger ... or a potential threat to humans and their welfare'* (Smith 1998:5). Hazards are either natural, technological or human induced. The occurrence of one or more of the above can result in various *disasters*. Natural hazards are defined by Burton, Kates and White (1978:1) as *'...those elements of the physical environment harmful to man and caused by forces extraneous to him.'* This includes natural phenomena such as atmospheric, seismic, geo-hydrological, tectonic and wildfire events, but excludes technological hazards (Burton et al. 1978; Smith 1998). "Natural hazards" have been considered an *Act of God* (Smith 1998:9), implying humans are not responsible for their occurrence and nothing can be done to mitigate such occurrences. Although humans can do little or nothing to prevent the occurrence of most natural hazards, they have a role to ensure that extreme natural events are not converted into *disasters* by their actions (Burton et al. 1978; Nimpuno 2001).

Man-made or human induced hazards are the result of technological systems and failure (Smith 1998). Man-made hazards are threats, having an element of human intent, negligence and involving failure of man-made systems (Legg 2005; Smith 1998). Therefore, man-made hazards are classified under a single broad concept as ‘*technological hazards*’ (Smith 1998:314). This includes transport systems failure (air, water and land), research failure (nuclear power: Chernobyl – Ukraine) and industrial failure (Bhopal – India) (Krejsa 1997; van Western 2005). As a result, humans are exposed to risk not only from ‘...*extreme geophysical events [such] as tectonic hazards, but also from industrial and other technological processes*’ (Smith 1998:314). In some cases, human actions may trigger, aggravate or increase the frequency of hazards that are usually considered natural events, for example, landslides or sinkholes associated with mining activities (Nimpuno 2001). In a similar manner, human actions can also reduce or mitigate hazards (Burton et al. 1978). Creation of hazard awareness and hazard educational programmes should be encouraged as part of measures to mitigate natural and technological hazards and to reduce associated *risks* (see below) (Ronan & Johnston 1981; Smith 1998).

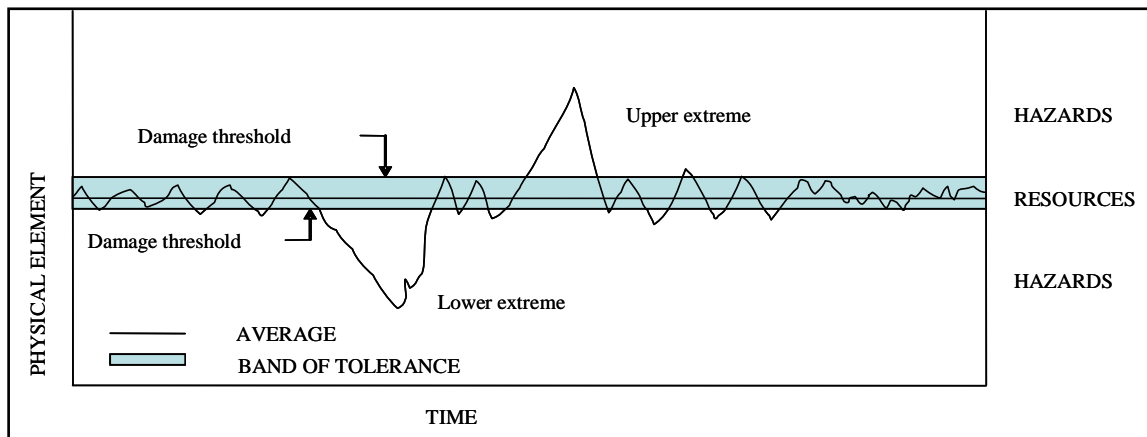
There is no uniform definition of *hazard*. The term is most often used in combination with the term *risk*. For example, a “hazard” is defined as *a danger or risk*, which explains the interchangeable use of the term (Hornby 1999:549). Harm associated with hazards may range from injury or illness to mega-disasters (Aguis 2009; HSHRS n.d.; OSH n.d.; Smith 1998). “Hazard” is the latent potential for damage, while “risk” is the *probability* of actual exposure of anything of value to the hazard (Smith 1998; Singley 2003). In a simple definition, a “hazard” is a source of danger if uncontrolled; “risk” is the probability of exposure to a hazardous substance or event, while “disaster” is the result of vulnerability and actual exposure to hazards and associated damage (Smith 1998; Stamatelatos 2000). Though the terms *hazard*, *risk* and *disaster* are often used interchangeably in common speech, in technical discourses they have distinct meanings that are not interchangeable (Singley 2003).

Related to this research case study, mining is general regarded as a hazardous activity due to its potential to cause harm in the environment and ecosystem, including human and properties. It is a risky activity with direct and indirect exposure of worker and resident to mining. A combine process of potential and risk might result to identified and unidentified health implications.

### 2.2.2 *Hazard Assessment*

Humans and possessions are the ‘...reference for all assessment and all disasters’ (Smith 1998:5). “Hazard assessment” is a process as required by law of identifying protective measures to reduce threats posed by natural and technological hazards. Hazard assessment comprises a process, often documented in a spread sheet template, whereby hazards are ranked by estimates of frequency or likelihood, duration and intensity. The severity of threat posed by a hazard is determined by the duration and frequency of occurrence, and severity or intensity of threat. “Hazard intensity” is the maximum deviation of a parameter above either the norm or the damage threshold, while “hazard duration” is the length of time the threshold is exceeded (Figure 4) (Smith 1998:11). There is no unique method of assessing hazards. Accordingly, hazards are assessed differently, using various techniques and considerations. Many attempts to scale the impact of hazards have failed, in part because of the difficulties in determining ‘...whether the impact is intense and local or diffuse and widespread’ (Smith 1998:14). In the workplace, “hazard assessment” is the process required by law of identifying hazards associated with defined tasks, jobs or events (Tech 2008). Once a hazard has been identified, measures are taken to determine the rate of frequency, intensity, duration of occurrence and how to eliminate or mitigate its impact (SIS 2007).

When faced with the threat of human life and property, hazard assessment techniques have always placed the environment last (HMSPF n.d.; Marsh & Garnham 1996). Considerations in categorising the severity of a hazard are based, for example, on the number of people killed or injured, and the financial value of property damage, which are, in turn, used by risk analysts to determine the margin of safety (Smith 1998). Assessment reports show that most natural hazards arise from geophysical events, or a combination of technological processes for example, coal mining (Tsinda & Gakuba 2010).



Source: Smith 1998:11.

**Figure 4: Sensitivity to environmental hazard expressed as a function of the variability of geophysical elements and the degree of socio-economic tolerance**

### 2.2.3 Risk and Risk Management

Hazard and risk co-exist in daily life (SIS 2007; Smith 1998). A “risk” is the probability that a hazard turns into an incident or a disaster, that is, the probability of incurring a misfortune (Singley 2003). It is a quantifiable likelihood of loss. A “risk” is the exposure of something of value to harm (Bayne 2002). Vulnerability and hazards are not dangerous, if taken separately, but a *combination* of both becomes a risk. A Chinese word for “risk” is *weij-ji*, meaning “*opportunity/chance and danger*” (Smith 1998:54). This implies risk is a combination of opportunity, chance and danger. Risks are considered serious when the effects are life threatening and the repercussions may result in mortality (McAteer et al. 2006; Torres-Dosal et al. 2007). Risk assessment is scaled “...on a probability of an event on a theoretical scale from zero to certainty (0 to 1)” (Smith 1998:6). This probability is then used to determine the degree of *risk*. This explains why persistent negligence in coal-mining communities may have severe repercussions over time (Lockie et al. 2009). For example, coal hazards and vulnerability of the communities of eMalahleni is gradual and lasting, while there are insufficient clinical reports of illness, injury or death. It is expected that, with technological advancements, it is possible “*to view all hazards [risk] as avoidable events*” and possibly under human control (Smith 1998:6).

Though risk cannot be completely eliminated, risk reduction and management are the best alternatives (Smith 1998). “Risk management” is a process of reducing the severity of hazards, the probability of occurrence, or the exposure to the hazard. The first step in “risk

reduction” is to identify the hazards, then evaluate the effects in a quantitative and integrated manner (Burke 2003; SIS 2007). In the course of “risk evaluation”, the potential and possible effects of the risk are considered.

“Risk assessment” is placed in two categories: (i) perceived risk and (ii) objective risk, which are dealt with in an integrated manner. The risk is then quantified by statisticians and other stakeholders with some uncertainties due to people’s opinions and perceptions. Many decisions and actions taken on hazards are based on personal perception of risk rather than on the level of threat. “*Risk perception is regarded as a valid component of risk management alongside other scientific assessments and methods*” (Smith 1998:55). This is simply due to people’s different perceptions and predictions from objective risk assessment models. These differences vary according to age, gender, level of exposure to hazards, level of literacy and social conditions (Smith 1998).

Analysing risk has been based on mathematical theories of probabilities, with two thoughts arising; that are, *objective statistical risk* and *subjective perceived risk* (Redmill 2002). These two mathematical concepts are difficult to separate clearly. This is attributed to value judgement in risk and the impact of time and space for the event. Therefore, decision-makers commonly accept hazard management based on individual choice and a range of other alternatives (Smith 1998). Risk assessments based on risk perception are always combined in environmental management (Touzet et al. 2000). By implication, there is no objective approach to risk management and a universal value system and subjective elements are applicable (Duffus & Worth n.d.). The negative outcome of any risk is a disaster.

#### 2.2.4 *Disaster*

A “disaster” is the outcome of a hazardous exposure to an event in which people are injured, displaced or killed, and properties damaged (Perry & Quarantelli 2005; Smith 1998). It is a result of interaction in time/space between physical exposure to hazards and vulnerable communities (Drimie et al. 2005). *Vulnerability* is the measure of risk exposure in the social and economic sense. Disasters are natural, human induced or technological (Drimie et al. 2005).

“Natural disasters” are the result of geophysical environmental events, for example, tectonic hazards which result in loss of life and property (Kent 1994; Smith 1998).

“Human-induced disasters” are the result of human error, malice, negligence and technological failure (Mulugeta n.d.), while “ecological disasters” are a psychosocial destruction that far exceeds the coping ability of nature to repair the damage, which upsets ecological communities and functionality of systems (Kent 1994; Sakurai & Miyata 2005). Disasters can be avoided or reduced by ensuring effective disaster-preparedness measures.

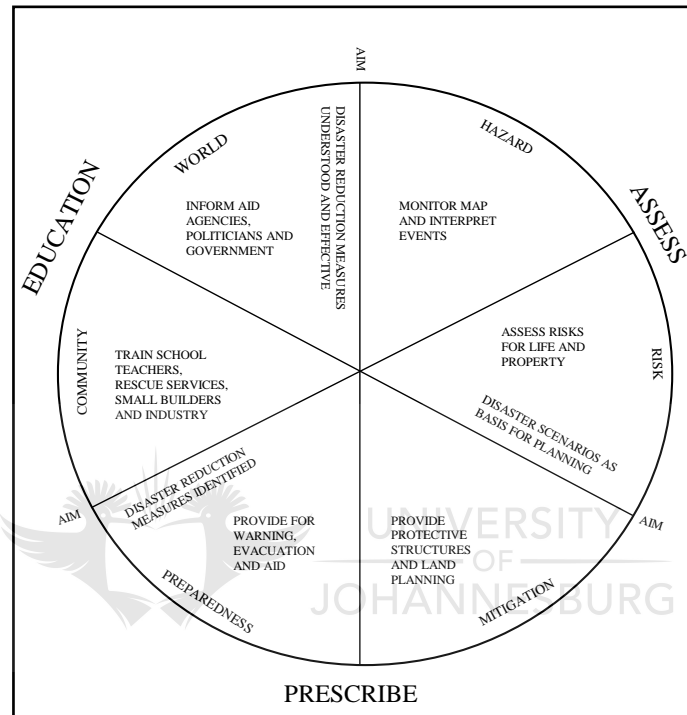
#### 2.2.5 *Disaster Preparedness*

“Disaster preparedness” is a process of pre-arranged measures taken to minimise loss of life, injuries, property damage and damage to the environment, prior to an event (Smith 1998). Disaster preparedness means knowing what to do before, during and after a disaster (Kent 1994). A number of sequential steps are followed, from planning to prompt and efficient response by individuals, companies and the State, once a hazard has been forecast (Smith 1998). Various disaster-preparedness initiatives have been used for different hazards. Some were effective and successful, such as the social response to hazards through public education and awareness programmes, for example, the automated hurricane warning in southern America (Newport & Jawahar 2003; Smith 1998). These are some of the most common disaster-preparedness steps so far exercised.

Disaster preparedness should serve as a point of reference for stakeholders in hazard decisions (Deneufbourg 2001), while pursuing a variety of social and economic goals. Lack of disaster-preparedness initiatives are a weakness in community safety as are institutional weaknesses, attributed to lack of technical expertise, poor enforcement of legislation and illiteracy (Smith 1998). Other setbacks include lack of financial and human resources, community unawareness and companies’ unwillingness to inform and educate the public on impending dangers (Smith 1998). In the absence of disaster preparedness, disasters could be aggravated.

“Disaster reduction” is a less costly initiative that can be undertaken through community preparedness programmes (Ritchey 2006). Disaster reduction programmes are a complex interaction and include education, assessment, prescribing hazard risk mitigation, preparedness, community and the world, including awareness and financial support (Figure 5). Complex disaster reduction programmes are uncommon in most developing countries including South Africa, where information is lacking. Politicians and decision-makers are passive about hazards and hazard-reduction measures, with priority

being given to other social problems like inflation, unemployment and crimes (Abramovitz 2001; Smith 1998). Interest is kindled only once an incident has occurred, implying disaster-preparedness programmes in developing countries are absent and disaster recovery is the only possible alternative (Fagen & Martin 2005). Irrespective of various and alternative attempts to reduce hazards, without adequate feedback, hazard assessment and disaster preparedness will probably fail in poor communities (Smith 1998).



Source: Smith 1998:75.

**Figure 5: Linkages between hazards, risk and disaster management cycle with assessment responses and education essential for successful disaster reduction**

### 2.2.6 Hazard Assessment and Disaster Preparedness in Developing Countries

Hazard assessment is a fundamental process in disaster preparedness. In developing countries, this fundamental process is often limited due to lack of information, poverty, illiteracy, unawareness, institutional weaknesses, lack of research, lack of monetary and human capital, and the unwillingness of the State and companies to inform and educate communities (Smith 1998; Yodmani 2001). This creates setbacks to effective community disaster preparedness and disaster management. Paradoxically, in developed societies ‘...long-term community disaster-preparedness programmes have proved very successful

*in reducing injuries and death*' (Smith 1998:105). Measures applied include good education and awareness programmes in hazard mitigation (Smith 1998; Yodmani 2001). Public institutions needed for disaster-preparedness initiatives, such as schools, hospitals, media communication, newspapers and theatres are readily available.

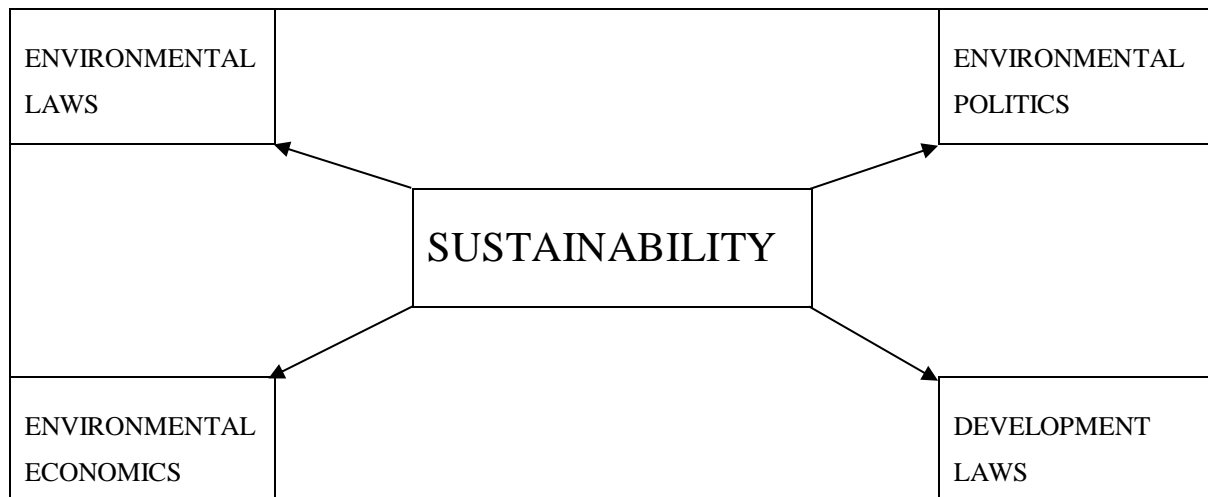
Programmes on hazards should be well coordinated in developing and developed societies. Ill-conceived awareness may create panic and other counter-productive attitudes (Smith 1998). It is advisable that such institutions and programmes are well coordinated in terms of social feasibility and economic consequences. The benefits cannot be measured in monetary terms, but through the upgrade of community awareness.

### ***2.2.7 Development and Sustainability***

The idea of sustainability in development is traced historically from the works of Ricardo, Malthus, Jevons, Mill and Rostow (Baker 2006). Sustainable development became a global agenda after the Brundtland Commission report in 1987, in '*Our Common Future*' (Schubert and Láng 2005). Since the Brundtland report, sustainable development has been defined in various ways to mean different things to different people (Baker 2006). It is a concept intended to improve the quality of life while preserving environmental resources for future generations (Collins 2001). It is the outcome, when people and government work together to improve human life, which implies more jobs and more opportunities. People rely on the Earth's resources; therefore, these resources should be preserved for the betterment of the economy and its people (Chaulya et al. 2002). Sustainable development has three recognisable facets: environment, social and economic (resources, people and development) integrated into a single perspective, with the fourth pillar (cultural sustainability) still debatable (Nurse 2006; Schaltegger, Burritt & Petersen 2003; Schuber & Störmer 2007).

Sustainable development cannot be realised without policy makers and policy instruments. These policy instruments consist of strategic environmental management planning, environmental management accounting, environmental auditing, environmental economics, environmental politics, development laws, environmental life-cycle assessment, environmental management standard schemes, and command-and-control systems (Figure 6). These policy instruments are applicable also in the mining environment.





Source: Researcher's own diagram.

**Figure 6: Sustainability policy instruments**

### 2.3 Mining and Sustainable Development

Mining has played a significant role in economic growth and stability in mineral-rich countries (mostly developed countries) including South Africa. Tax revenues from minerals, specifically coal and oil, have been used, among many other purposes, for poverty alleviation. Paradoxically, mineral-rich developing countries remain below the Human Development Index (HDI). Evidence shows that the human development index is low in countries and communities where minerals are exploited (Tamufor 2009; Upton 2010). Mineral-rich developing countries are expected to exercise environmental best practices in accordance with the highest international standards (IMF 2007; Asfaha 2008; Sotham 2010), which are often more stringent than local national standards. In the absence of external finance and associated enforcement, environmental best practice is seldom adhered to, for instance in artesian gold mining in Brazil and diamond mining in Zimbabwe (Hoogbergen & Kruijt 2004; Blight & Fourie 2003). The disparity in mining practice is not limited to developing countries in Africa. Developed countries also do not adhere strictly to the principles of sustainable mining as agreed on at the WSSD. As early as 1974 Arrow and Fisher (1974) noted there was a gap between expectations and actual practice among both developed and developing countries and, as at 2008, the situation remains unchanged (Galizzi & Herklotz 2008). A good example of a disparity gap was experienced in the United States of America, with its persistent refusal to sign the Kyoto Protocol on carbon emissions, coupled with laxity in enforcing environmental legislation on mines, resulting in the fatal American Coal Mine disaster at Sago Mine (Annexure 1)

(Langfitt 2006a; Singer 2004). This disaster was felt by the entire mining community and its families, because businesses had submitted appraisals in the company's interest (UNESCO 2002).

Mining companies are noted for written appraisals on sustainable achievement (BHP Billiton 2005; Gold Fields 2005). According to Schaltegger et al. (2003), sustainable development is a core objective of business. As a result mining companies should operate within the principles of sustainable development. In effect, sustainable development should be guided by policies and enforced by laws (Mabiletsa, du Plessis, Pienaar & Potgieter 2001). In South Africa, mining companies are expected to provide reports of their activities on all spheres (social, economic and environmental) to the local government authorities and responsible authorities (BHP Billiton 2005; Gold Fields 2005). These reports should then serve as a framework for corporate governance and management, as adopted from the WSSD/JPOI mining guidelines by the South African mining sector (Ogola, Mitullah & Omulo 2002). These guidelines are reviewed in the next section of this chapter.

The next section of this chapter reviews: (i) policy documents arising from the WSSD/JPOI with respect to environmental, legal and ethical responsibilities of the mining industry; (ii) activities and practice by mining companies in relation to hazards posed by the coal-mining industry; and (iii) the social impact of coal-mining hazards on South African mining communities relating to health awareness, environmental awareness, information, communication and education. These initiatives are examined in terms of the understanding of sustainable development in the South African coal-mining context.

## **2.4 Review of the WSSD/JPOI Guidelines for Mining Industries**

Those who attended the WSSD in Johannesburg in August and September 2002 were certain that the use of coal, despite concern about its adverse greenhouse emissions, is compatible with, and essential for, sustainable development if used in a proper manner. This was emphasised by international organisations and financial institutions. For example, the World Bank (UNESCO 2002:2) commented that

...reliable energy is a key component of economic and social development. Lack of energy is among the key forces slowing down poverty reduction and growth of the rural sector.

The World Bank stresses that improving energy services will enhance indoor air quality, reduce health hazards and bring about environmental benefits. The World Bank policies

are therefore encouraging the harvesting of all forms of energy, including fossil fuels. Sustainability considerations of coal, as a unit of the fossil-fuel sector, were entrusted by the United Nations Environment Programme (UNEP) to the World Coal Institute.

The World Coal Institute is the leading global coal organisation promoting: (i) coal as a strategic resource essential for a modern quality of life; (ii) coal as a key contributor to sustainable development and an essential element in enhanced energy security; (iii) technological innovation; and (iv) improved environmental outcomes within the context of a balanced and responsible energy mix (WCI n.d.(b)). The World Coal Institute was asked to prepare a summarised report on the achievement of the coal industry prior to the 2002 WSSD and a programme of action to promote sustainable development. The World Coal Institute devoted time, briefing policy makers on the role of coal and efforts being made by the industry towards sustainable development. At the end of 2001, the World Coal Institute published a document *Sustainable Entrepreneurship, the Way Forward for the Coal Industry* (SE 2001; WCI 2002; WCI n.d.(b)). This mining-sector-outlined document was presented and adopted at the WSSD 2002 as the principles/objectives for minerals and mining.

#### **WSSD principles/objectives for minerals and mining**

The following are the principles/objectives specifically on coal as related to this research in the context of the South African coal-mining industry. These outlines prompted the World Coal Institute to:

- Provide a voice for coal in international policy discussions on energy and the environment
- Promote the role of clean-coal technologies in improving the environmental performance
- Highlight the valuable role affordable and abundant coal resources play in a world ever more concerned with energy security
- Improve understanding of the importance of coal as the single-largest source of fuel for electricity generation and its vital role in other industries, including steel production, cement manufacturing, chemical and liquid fuels
- Form strategic partnerships and alliances to coordinate actions and maximise resources to improve the perception of coal worldwide



- Ensure decision and opinion makers are fully informed of the contribution of coal to social and economic development, and
- Address misconceptions about coal through the production and dissemination of information (WCI n.d.(c):3).

These guidelines were presented and approved by the WSSD signatories, in which South Africa was represented. These guidelines were overarching and individual countries were to adopt these guidelines into a framework-of-action plan with considerations given to local legislative application. In South Africa, the Department of Minerals and Energy was entrusted with the above duties.

## **2.5 Review of Policy Documents and Practices Post WSSD/JPOI**

This section reviews the policy documents, activities and practices adopted by the South African mineral sector post the WSSD/JPOI relating to hazards posed by the coal-mining industry.

The Department of Minerals and Energy adopted the WSSD mining guidelines as proposed alongside South African local legislation (Kabemba & Southall 2010). By adopting these new mining guidelines, some existing regulations were altered (Gcabashe & Gaven 1998). The adoption of these new guidelines was done through the launching of specific mining programmes. The Department of Minerals and Energy launched Sustainable Development in Mining (SDM) 2004 to 2010, a programme intended to guide the mining industry to its highest commodity contribution by the year 2010. Coincidentally this is the year set by the United Nations Commission for Sustainable Development (UNCSD) to report to the WSSD on mining and waste management (Swart 2005; DME 2007b). Following these initiatives, the Director of Mine Environmental Management in the Department of Minerals and Energy commented that good governance can be achieved through improving the health, safety, income and living conditions of the poor majority (Swart 2005). Therefore, economic growth, greater equity, and self-reliance can be ensured through sustainable use of natural resources. The Director urged South Africa to implement the following sustainable development initiatives: the identification and prioritisation of opportunities and constraints that influence performance, and the rehabilitation of derelict and ownerless mines. These strengthened and enforced social issues, such as training, skill development, women in mining and Black Economic Empowerment (BEE) (Swart 2005).



Through the launching of projects, the Department of Minerals and Energy entrusted Coaltech<sup>7</sup> with the responsibility to appraise the WSSD/JPOI-approved guidelines and design a similar, but effective, guideline in the South African context (Goodale 2008). Coaltech designed two guidelines for the South African coal industry: general guidelines for major coal industries, and specific guidelines for small-scale coal-mining industries (Goodale 2008; Mutemeri & Petersen 2002). These guideline documents were entitled '*Best Practice Guidelines*'. Both the general and the specific guidelines were designed with consideration for the South African constitutional and other legislative requirements. According to Lloyd (2002) these guidelines were enforced by the Minerals Act, Act No. 50 of 1991 (RSA 1991); the Mine Health and Safety Act, Act No. 29 of 1996 (RSA 1996b); the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998), and the Mineral and Petroleum Resources Development Act (RSA 2002). These guidelines place emphasis on risk assessment, dust suppression, spontaneous combustion, heat resistance and other matters affecting mining and communities.

A clause within the WSSD guidelines requires regional and continental cooperation among mining industries and regulative bodies. The Department of Minerals and Energy created internal organs to participate in continental bodies. The Chamber of Mines of South Africa (CoM) became a useful channel for mine management (DME 2009). At continental level, South Africa is a member of the African Mining Partnership, an international process and structure established to coordinate the activities of the New Economic Partnership for African Development (DME 2007a). The African Mining Partnership adopted mining guidelines for the continent of Africa and within the South African mining sector. These institutions made some practical inputs into the South African coal-mining economy, with a focus on coal hazards encountered by communities surrounding mining operations.

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<sup>7</sup> The Coaltech Research Association was established 1999 and is a collaborative initiative to develop technology and apply research findings to enable the South African coal industry to remain competitive, sustainable and safe [<http://www.coaltech.co.za/>].

## 2.6 The Social Impact of Coal-Mining Hazards on Communities in terms of Health, Environmental and Information Awareness

The WSSD/JPOI guideline document identified the adverse effects of mining and proposed a review of mining activities in general. In South Africa, the adopted guidelines examine mining in a similar context – the coal-mining sector was requested by the Department of Minerals and Energy to review its activities accordingly. This was done through the creation of local initiatives and the assigning of the task to specific bodies: the Council for Scientific and Industrial Research and Mintek, both State research institutions, carried out research on the effects of derelict and ownerless mines (Webb 2005; Mintek 2010). These initiatives compelled mining companies to establish the current sustainable development constraints, the gaps and how to tackle them. Besides the constraints on derelict mines, there are operational mines which might close during the next 10 years. South Africa reportedly has 1 000 operational mines which were to convert their rights and update their environmental management programmes and plans (EMP/P) (Swart 2005:16). The Council for Scientific and Industrial Research, Mintek and other institutions developed a *personal digital assistant-enabled site inspection assistance tool* (SIAT), to assist environmental officers when conducting environmental inspections (Swart 2005:16). Other local initiatives established were mining standards, accountability, verification, quality assurance and certification in mining.

These local initiatives and the involvement of stakeholders inspired an increase in environmental awareness, with recognisable interest in hazards from mining activities. A series of debates arose from the issues of hazards in derelict and ownerless mines. One such debated issue was entitled: “*Ghost of the past could come to haunt firms*” (Wray 2005:16). Quentin Wray, a news reporter wrote on issues relating to triple-bottom-line reporting and stressed how the

... industrial empowerment charter took over related job losses and the rehabilitation of abandoned and dangerous mine dumps...[Quentin Wray raised the following questions:] ...to what extent should business be expected to do more than just pay their taxes and obey the law? ...how much responsibility should corporate citizens take for past ills? ...[And] ...should the needs of 1 000 sacked workers trump the fact that thousands of others have more secure jobs ...? (Wray 2005:16).

These were some unanswered questions troubling mining in South Africa. The debate continued on the question of abandoned mines. Wray argued that the laws at the time did

not require companies to sort out their mess when closing down. Therefore, the introduction of environmental laws that force companies to rehabilitate are relatively new and were promulgated after 1994, while some of the mines had been abandoned for years. There was no framework to deal with what would become of the mines and communities that served them (Smith 2005).

The debate revealed further that there are an estimated 8 000 derelict and abandoned mines scattered across South Africa, of which 111 comprise asbestos mines (Smith 2005). It is estimated to cost billion rands to rehabilitate them. The argument continued with puzzling questions:

...should companies that did nothing illegal at the time be held liable for these costs?  
If laws cannot be enforced retrospectively, what recourse should the State have even if it can identify the owners? (Smith 2005:15-16).

Therefore, the State should assume responsibility where the laws failed leaving the citizens, the environment and economy vulnerable.

Grappling with arguments regarding abandoned mines in South Africa, the government aligned with UNEP support and the International Council on Metals and the Environment (ICME) to launch a programme on Awareness and Preparedness for Emergencies at a Local Level (APELL) (ICMM 2005). APELL provided a framework to help companies and stakeholders prepare for emergency response plans when dealing with major incidents. APELL encouraged industries to raise public awareness in mining and metal industries and to pro-actively engage with communities. APELL is a two-way process of helping mining companies to develop technical tools for responding to incidents and to recognise the need for communicating their approaches to communities (ICMM 2005). A review of the South African guideline principles/objectives and initiatives revealed a lack in effective implementation of the APELL requirements (DME n.d.; Swart 2003).

This inefficiency in policy implementation is applicable not only in South Africa. According to Andrews (2008), coal mining has been considered in America as the deadliest industry. Washlaski and Washlaski (2008) also emphasised failure in the coal-mining industry by tracing the history of mining in the county of Connellsville, Pennsylvania State. *'Since 1870, Pennsylvania's annual report on mining activities has recorded 51 483 deaths from mining accidents'* (Washlaski & Washlaski 2008:1). This statement may be true when looking at and analysing the hazardous nature of coal mining,

mining accidents, diseases and the vulnerability of mining communities (Annexure 1). In South Africa such details relating to numbers of deaths, injuries and accidents are either confidential or non-existent, thus showing the uneven relationship between mining companies and local communities.

## **2.7 Outcomes of WSSD/JPOI Policy Documents and Implementation in the South African Context**

Though international efforts are needed to address environmental, legal and ethical responsibilities in the mining industry as outlined in the WSSD/JPOI documents, domestic policies, legislation, marketing policies and other measures can also make major contributions. Energy was a priority among the objectives of the WSSD/JPOI and the need to move towards cleaner energy (Spalding-Fecher, Winkler & Mwakasonda, 2005; Winkler, 2005). Coal is an example of an energy resource in need of cleaner technologies to become sustainable. Reviewed documents revealed that, though coal was prioritised as an energy source for economic growth, the means to drive the WSSD/JPOI programmes forward is inadequate and in most cases lacking in infrastructure investment (Davidson & Sokona 2002). The concept of clean-coal technology was highly debated during the WSSD but no concrete resolution was arrived at, due to conflicting views. Access to energy identified as an ethical responsibility did not gain meaningful recognition post the WSSD. Most communities in developing countries, including South Africa, are still in need of affordable energy (Davidson & Sokona 2002; Spalding-Fecher et al. 2005; Winkler, 2005).

Another ethical responsibility arising from the reviewed WSSD/JPOI documents concerns the environmental effects of coal use. Air pollution is the most notable impact of indoor coal use by communities. The WSSD proposed holistic plans of action that could not be implemented in individual countries. For example, an alternative to cleaner energy has not been identified in the South African context, though a national programme on coal-smoke reduction was launched known as *Basa njengo Magogo*. The WSSD supposedly was an opportunity to take stock by identifying national and international action plans towards an improved energy source, but failed due to conflicting energy interests (Spalding-Fecher et al. 2005; Winkler, 2005). Attempts through a comprehensive plan of action to address energy challenges, drawn up by the African Group, has slowed down due to lack of finance, capacity, technology transfer and national incentives.





As a follow-up to the WSSD mining outcome, the Department of Minerals and Energy initiated a programme from 2005 to 2008 to adopt and develop a strategy to address mining challenges in South Africa (DME 2009). By 2008, the following strategic objectives were arrived at specifically:

That the South African mining sector reflects the sustainable development values, principles and aspirations of the country. All stakeholders in the sector must share a sustainable development vision based on a culture of mutual respect

The vision of sustainable development in the sector must be communicated effectively to all stakeholders

To recognise that sustainable development strategy and policy must transcend both the government of the day and the requirements of the United Nations Conference on Science and Technology for Development and should be valid and appropriate across all time scales. Furthermore, the country empowerment and environmental and social rights are central and enduring tenets of the sector and that all those operating within the minerals sector earn a social licence to do so

That the Sustainable Development Strategy facilitates the transition from finite resource-based industries and economies to sustainable knowledge-based economies and that building and accounting for social and natural capital is implicit

That the sustainable development strategy promotes economic diversification in existing and future mining industries and that the minerals sector should take due cognisance of globalisation's influence on sustainable development and the consequences of these (including the implications of trade barriers, global market forces, international agreements, requirements and conventions)

That the sustainable development strategy acknowledges the potential and realised contribution of the industry for socio-economic empowerment and that policy creates conditions to ensure the continuation of this contribution

That value extraction from South Africa's mineral sector benefits vulnerable groups and value addition from South Africa's mineral resources is maximised locally

That government is empowered to facilitate sustainable development outcomes and link to national and international sustainable development strategies and initiatives and that all role players realise the synergies achieved through effective cooperation and

That the minerals sector moves towards sustainable end-states and internalises negative costs and associated consequences and that the cumulative and life-cycle



aspects of the sector are fully aligned with sustainable development principles (DME 2009:375-376).

The above guidelines were drafted, adopted and placed under sustainable development in mining (SDM) (DME 2005; DME 2009). This is a generalised programme initiated by the Department of Minerals and Energy which intended to review all mining activities in South Africa. It extended beyond to the challenges of coal mining and was based on the specific guidelines of coal as outlined by the World Coal Institute. Though South Africa adopted the WSSD/JPOI guidelines, they were not applied sequentially as other considerations and legislation were yet to be amended. Among the WSSD/JPOI guidelines, there was a recommendation for inter- and intra-regional and continental cooperation.

South Africa collaborated with other continental bodies such as the African Mining Partnership and the African Ministerial Meeting on Energy under the New Economic Partnership for African Development. These continental bodies formulated comprehensive guideline principles, objectives and actions to drive sustainable development on the African continent and in the coal industry specifically. South Africa is an active member of the above bodies and is contributing to sustainable mining at continental level (Mutemeri 2007; SAPP 2010).

The overall outcome of the reviewed documents of the WSSD/JPOI and the adopted guidelines by the Department of Minerals and Energy resulted in a new rational approach. South African mining companies in general and coal mining in particular responded in a comprehensive approach to the understanding of these guidelines and the term “sustainable development”. As a requirement, mining companies responded in annual reports and through accountability reporting. For example, in the 2003/2004 financial year, mining contributed 6.6 % of GDP, the same level as in 2002/2003. Industrial growth stood at 4.2 %, platinum group metals (PGM) production, combined with growth in diamonds mined was 11.9 %, coal was 6.2 % and iron ore was 3.6 %. The non-gold-mining sector grew by 7.6 % in 2004 (SAMISTR 2005:35). Unfortunately, the gold sector continues to impact negatively on the Rand with the cost of production rising by 7.2 %. Mining grew by 3.7 %, with a 7 % employment in the non-agricultural formal sector. The private sector grew by 9 % with

R34.3 billion paid to employees as wages and benefits, which amounted to 7 % of total compensation paid to private sector employees in 2004 (SAMISTR 2005:35-36).

Coal made a significant contribution to the South African marketing system (Table 1). The publications also covered the market role played by the mineral sector in the demand-and-supply relationships with South African banking and financial institutions, and the construction, engineering, manufacturing, transport and processing sectors.

**Table 1: South Africa's annual coal sales (tonnes)**

<b>Year</b>	<b>Sales (tonnes)</b>
<b>2000</b>	224 519 089
<b>2001</b>	224 374 421
<b>2002</b>	222 038 018
<b>2003</b>	236 430 342
<b>2004</b>	246 318 785
<b>2005</b>	245 091 923

(Source: SAMISTR 2005:35-36).

The report findings also emphasised eco-marketing through consumption and disposal behaviours, through which marketing perspectives were broadened. There were also environmental appeals by business and public institutions to encourage better behaviour in the disposal of by-products and product parts. Practices such as waste separation, unpackaged products and the introduction of environmentally friendly products provide consumers with opportunities to protect the environment at less cost. The mining industry, in collaboration with the financial institutions, reflected their annual environmental expenses. Visible evidence of corporate social responsibility in communities surrounding mining industries is scant as companies are answerable only to the Department of Minerals and Energy. It is doubtful whether reports submitted to the Department of Minerals and Energy reflect the reality of the communities surrounding mining operations and the relationship of these communities with the mining companies. Written reports made public promote the interests of the mining company and are written by internal management staff or paid researchers (Annexure 2). These reports are seldom accessed by municipal authorities and communities.

Public financial accounting reports are limited to company cost and management statements, which are duly required by the Chamber of Mines of South Africa. For example, the Chamber of Mines of South Africa Annual Financial Statements for the year ended 30 June 2004, approved by the Executive Council on 15 September 2004, and the annual balance sheet of the company's assets and liabilities are presented in Annexure 3. No environmental cost was included in the annual financial reports. According to the principles/objectives of the UNEP, the WSSD, and the World Coal Institute, environmental reporting, communication and auditing should be a prime requirement in mining. It is an accepted requirement on paper that is implemented on selective aspects of the business.

Prior to 1994, mining activities in South Africa were characterised by many problems [Integrated Regional Information Networks (IRIN 2008)]. After 1994, new legislation was passed to enforce environmental practices, reduce mine accidents and improve health reporting, and the interests of communities were considered. Health impact was linked to the consequences of mine dumps, abandoned and derelict mines and acid mine-water drainage over the years (IRIN 2008). Though there were gradual improvements on these aspects, the WSSD brought about a significant change in the practice and perceptions. A good example is the pace at which mining incidents are currently reported. Mining incidents are presently open to transparency and public communication (CoM 2004). Therefore, sustainable development in mining in South Africa is measured by the number of people informed of mining incidents (Hounsome & Ashton 2001). However, this is not necessarily a good measurement indicator as the bulk of the illiterate communities are omitted. By reporting mining incidents, mining in South Africa has moved from a previously deadly industry to an industry in transition with isolated incidents. According to the South African Mines Reportable Accident Statistical System (SAMRASS 2001) database, coal-mining fatalities and injuries are much lower (Table 2).

**Table 2: Fatalities and injuries in different mining sectors during 2001 and 2002**

Sector	Fatalities			Injuries			Days lost
	Number		% of total	Number		% of total	Days/worker
	2002	2001	2002	2002	2001	2002	2001
<b>Gold</b>	174	182	60.5	3 286	3 374	74	29.1
<b>Coal</b>	19	19	6.6	159	170	4	15.9
<b>Platinum</b>	53	49	18.4	658	797	14	14.3
<b>Other mines</b>	42	38	14.5	350	387	8	14.4
<b>Total</b>	<b>288</b>	<b>288</b>	<b>100</b>	<b>4 453</b>	<b>4 728</b>	<b>100</b>	

Source: Mine Health and Safety Council (MHSC 2003:10).

Another contribution made during the WSSD is the level of hazard awareness at mining sites regarding air-borne pollutants (Table 3).

**Table 3: Worker exposure to airborne pollutants from various commodities for 1999 and 2000 as a percentage**

Commodity	Number of Miners	Percentage of Workers Exposed 2000	1999
<b>Gold</b>	69	6.62	4.92
<b>Coal</b>	83	30.94	25.10
<b>Platinum</b>	18	1.03	1.09
<b>Other mines</b>	278	4.23	5.65
<b>Total</b>	<b>448</b>	<b>8.52</b>	<b>6.14</b>

Source: MHSC (2001:8).

The result also revealed that mining in South Africa is proceeding towards sustainable development and coal mining has acquired a better position of safety compared to other mining activities (MHSC 2003). However, coal mining is still a dangerous occupation in terms of diseases and death not caused by mining accidents (MHSC 2004). Statistics representing fatalities and injuries in different mining sectors during 2002 and 2003 are shown in Table 4.

**Table 4: (a) Fatalities and (b) injuries in different mining sectors during 2002 and 2003**

(a) Fatalities	Total		Fatalities in sector as a % of total	Per million hours worked	
	2003	2002		2003	2002
<b>Sector</b>					
<b>Gold</b>	146	175	55.3	0.37	0.44
<b>Coal</b>	22	20	8.3	0.20	0.20
<b>Platinum</b>	58	53	22.0	0.24	0.26
<b>Other Mines</b>	38	45	14.4	0.23	0.30
<b>Total</b>	<b>264</b>	<b>293</b>	<b>100</b>	<b>0.29</b>	<b>0.34</b>

(b) Injuries	Total		Injuries in sector as a % of total	Per million hours worked		Total days lost/worker	
	2003	2002		2003	2002	2003	2002
<b>Sector</b>							
<b>Gold</b>	3 076	3 286	-2.1	7.69	8.32	25.4	28.1
<b>Coal</b>	186	159	0.27	1.73	1.59	10.3	13.6
<b>Platinum</b>	738	658	0.8	3.00	3.19	12.5	12.1
<b>Other mines</b>	290	350	-0.6	1.78	2.36	12.9	12.7
<b>Total</b>	<b>4 290</b>	<b>4 453</b>		<b>4.68</b>	<b>5.24</b>	<b>18.0</b>	<b>19.9</b>

Source: MHSC (2004:15).

The reviewed WSSD/JPOI documents, as adopted by the South African Department of Minerals and Energy, revealed that mitigation of the historical, social and economic consequences of mining has been enshrined in South African legislation. Though enacted as law, its implementation is lacking in most cases. For example, Section 100 of the Mineral and Petroleum Resources Development Act (RSA 2002) has never been enforced as the State and mining companies are evasive on this clause. Section 100 of the Mineral and Petroleum Resources Development Act requires companies

in consultation with the Minister of Housing and Development to propose a housing and living conditions standard for the minerals industry and develop a code of good practice for the minerals industry in the Republic.... (RSA 2002).

This Act was enacted in 2002 and (even in 2011) there is no clear action plan to redress the historical impasse. There is still a visible impact of mining on communities which have been blamed mostly on physical aspects of mining rather than on social, economic and political neglect. Though there is a strong correlation between the physical and the socio-economic failure. The latter are a factor of political neglect, unawareness, lack of information, communication and poor legislative enforcement.



The final outcomes of the reviewed WSSD/JPOI documents are integrated in Chapter 5 (Results), after the evaluation of the social survey outcomes described in Chapter 3 (Methodology and Data Collection) and Chapter 4 (Data Analysis and Preliminary Results). A combination of the analysed outcomes, coupled with the findings in Chapters 3 and 4 are analysed in Chapter 5 (Results). The Interpretation is presented and discussed in Chapter 6. Chapter 7 contains the Conclusions and Recommendations.

## **2.8 Conclusion**

The United Nations Conference on Environment and development held in Rio de Janeiro in 1992 outlined fundamental principles and programmes for achieving sustainable development. These principles become known as the Agenda 21. The outline principles discussed under agenda 21 was assessed in the Johannesburg Plan of Implementation in 2002. New and reviewed documents on the way forward for sustainable development were tabled in 2002, resulting to a number of key debates raised especially on the minerals and energy sectors. Some of the key debates and issues raised during the conference plenary were set as targets and guidelines to the South Africa mining sector. A number of legislations relating to mining were assessed. A number of weaknesses within the South African legislation were identified. Statutory bodies were formed and empowered to coordinate mining activities in South Africa. For example the Chamber of Mines of South Africa was formed and entrusted with the authority to enforced reportable mining incidents through sustainable mining practice and annual reporting. The chamber of mines of South Africa is also responsible for the cording of mining activities and corporation with other mining bodies in Africa. Although, the chamber of mines reviewed mining companies' annual reports on mining activities, environment and sustainability, the actual environmental cost and expenditure were mostly kept private. This is evident of the broadness and perception of sustainable development.

## **Chapter 3:            METHODODOLOGY AND DATA COLLECTION**

*This chapter deals with the techniques of data collection, through the application of structured questionnaires, voluntary comments, individual interviews, a focus group discussion and photographic images. The chapter describes and explains the overall design and administration of the questionnaires. It explains each section of the questionnaire survey instrument, data screening and processing. It describes the processes of individual interviews, the focus group discussion and categorisation of the voluntary comments. The chapter identifies the four broad research areas and sub-sections of each section and explains briefly the relevance of each section to the research objectives and tabulations of the preliminary data obtained.*

### **3.1    Data Collection and Validation of Questionnaires**

#### **3.1.1    Structure of Questionnaires**

Data was collected using structured questionnaires addressed to members of the community. The same structured questionnaire instrument was administered to two groups: *learners* (Grades 10 and 11) and the *general adult population* (henceforth referred to as the “general population”).

These two groups were selected intentionally to assess the influence of workplace democracy and freedom of information as required by the Mining Charter Sustainable Development Reports (SDRs) (SDR 2006). Further, the selection was meant to assess the impact of the current school curriculum relating to environmental issues on the perceptions and understanding of learners. Questions were formulated to assess knowledge over a range of issues, from general knowledge of the bio-physical and social environment, to specific aspects in the community and mitigation measures implemented by the coal-mining industry, the municipality, the community and State departments. All questionnaires were structured to address one or more of the following: (i) community awareness of coal-related hazards; (ii) issues of environmental education and information; (iii) mitigating measures applied to coal-related hazards in the community; (iv) indirect assessment of the mining companies through community information from workers and non-workers (including retired workers); and (v) perceptions of coal-related hazards on the community.



The assessment of the mining companies activities and actions through community information from mine workers specifically and non-mine workers is designated in this research as the *indirect assessment approach* or *third-party approach*. A third-party approach is a technique to assess the community's perceptions through possible responses from mine workers who were off duty, retired mine workers and adults employed elsewhere. The intention was to assess the ways in which company information flowed into the community, the concept of workplace democracy and freedom of information. This approach was applied in schools to probe the role of schools in raising knowledge and awareness about behavioural changes. In Chapter 4 (Data Analysis and Preliminary Results), comparison is made of the responses from the learners and the general population. To substantiate the credibility of this approach, quotations are drawn from the open-ended questions, voluntary comments, individual interviews and a focus group discussion to add qualitative support to the argument.

Nine schools were targeted, with each school having Grade 10 and 11 learners in five or six classes per grade, with an estimated population of 35 to 55 pupils per class. A period of five months was planned to complete this task, based on thrice-weekly visits to the schools and the community.

Questionnaires were structured to identify respondents' personal details besides other inputs (Figure 7). Each questionnaire had the following fields: *name of the community; place of work; name of person; position/occupation; age; years of residence within the community* and *date of completion*. These personal details were classified into primary and secondary information. The **primary information** was mandatory and missing values resulted in the questionnaire form being withdrawn from the research project. The compulsory information required was: *years of residence in the community; age; position held/occupation*. The **secondary information** was: *name of the community; name of the person* and *date* (of filling in the form). Omitted secondary information did not disbar the questionnaire from being used in the project.

For a completed questionnaire to be valid, a respondent should have resided within the community continuously for at least three years, and be older than 17 years of age. Thus, anyone resident in the area for a shorter period, though perhaps older than 17 years of age, had their completed questionnaires disregarded. The screening and validity criteria were based on the expectation that, after having lived in the area for at least three years,

participants would be able to provide an account based on personal experience – or an eye-witness experience – of someone who had suffered from an illness related to his/her occupation, the surrounding environment and the use of coal. It is also expected that during an extended period of residence, respondents might have encountered one or more of the following environmental events: a plume of smoke from industrial coal burning; smoke from indoor coal burning; dust blowing during early spring (August, September); smoke trapped at low level due to temperature inversions; the effects of vibration during blasting and other physical elements (such as near-surface spontaneous combustion of coal seams).

A minimum age of 17 years was adopted for the learners, as it was the average age of most Grade 10 and 11 pupils. It is at these grades that the new school curriculum deals with “sustainable development” learning areas from which the learners should be able to apply and relate the knowledge gained in the classroom to their surrounding environment. Learners of this age should also be able to reason independently and generate valuable inputs.

Questions were structured in English, which is the official language of academic instruction in the schools visited, though not the primary language of daily communication within the community. Interpretation was accepted orally where possible and necessary. Questions were structured on broad-based and specific patterns. The broad-based questionnaires used generalised terms, for example, “hazard” refers to “any harmful act or event”. Specific questionnaire patterns used precise terminology, for example, the “*hazard of air pollution*”, referring to the harmful effects of the air quality generated by industrial activities.

The research structure was divided to cover four broad sections comprising: health and safety; disaster preparedness and awareness response; strategic environmental management decisions/planning; and environmental legal application and compliance. Each section was further divided into sub-sections (Table 5). A questionnaire comprised of a subheading (for example, “dust exposure”) with a number of structured questions assessing a range of knowledge related to the specific heading. There were in total 19 sub-section headings, containing 151 multiple-choice and 13 open-ended questions.

**Table 5: Arrangement of research questionnaires by section and sub-section**

Area	Section	Sub-section heading
<b>1</b>	<b>Health and Safety</b>	Dust Exposure Noise and Vibration Exposure Temperature and Heat Exposure Coal-mining and Coal-processing Gases Health and Hazard Exposure
<b>2</b>	<b>Disaster Preparedness and Awareness Response</b>	Coal Fires and Fire-Fighting Equipment Air-Quality Monitoring Explosives and Explosions Underground Surveillance
<b>3</b>	<b>Strategic Environmental Management decisions/-planning</b>	Environmental Hazards and Planning Decisions Environmental Research on Hazards Equipment for Hazard Management Monitoring and Control Systems for Hazards Improve Risk and Awareness Practices
<b>4</b>	<b>Environmental Legal Application and Compliance</b>	Environmental Legislation on Hazards National Environmental Management Act, Act No. 107 of 1998 (RSA 1998) Environment Conservation Act, Act No. 73 of 1989 (RSA 1989) Minerals Act, Act No. 50 of 1991 (RSA 1991) Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002)

A set of questions (Annexure 4) was compiled per heading, with the demographic information section repeated at the top of every questionnaire (Figure 7). This was to facilitate the administration of each questionnaire to a respondent, independent of questionnaires from other sub-sections. This technique allowed for randomised questionnaires to be assembled into units, so that each respondent would complete only one unit (consisting of two questionnaires), in order to encourage the respondent's cooperation. This strategy is discussed below in detail. The questionnaires contained multiple-choice and open-ended questions.

**Name of Community** \_\_\_\_\_

**Name of Person** \_\_\_\_\_

**Position Held and Occupation** \_\_\_\_\_ **Age** \_\_\_\_\_

**Years of Residence** \_\_\_\_\_ **Date** \_\_\_\_\_

HEALTH AND SAFETY: DUST EXPOSURE					
	Question	Yes	No	Sometimes	Other
1	Are you aware of dust coming from mines?				
2	Are you aware of dust within the community attributed to mining activities?				
3	Are you aware whether any mining company carries out dust control within the mining community?				
4	Are you aware of the hazards of coal-dust exposure?				
5	Has any mining company ever educated your community on the hazards of coal-dust?				
6	Has the municipality ever educated your community on the hazards of coal-dust?				
7	Are there any reports or information provided to your community on dust control by a mining company?				
8	Are you interested to know about coal-dust control by a mining company?				
9	Is there any clinical survey/report done on coal-dust-related diseases within your community?				
10	Are the workers informed about coal-dust and related diseases?				
Comments:					

**Figure 7: Example of a structured multiple-choice questionnaire on dust exposure**

The multiple-choice questions were intended primarily for quantitative input, while the open-ended questions were for knowledge-based (qualitative) input. The multiple-choice questions were graded and required a tick (√) or (×) response in one of four optional boxes: (i) YES (“strongly agree”); (ii) NO (“strongly disagree”); (iii) SOMETIMES (“unlikely”); and (iv) OTHER (“not certain” or “no idea at all”). A non-response was deemed to be

“Abstained”. The open-ended questions required a word or short phrase response. The multiple-choice and open-ended questions were presented on the same form. At the bottom of every questionnaire was a space for a voluntary comment. This allowed respondents to make an optional voluntary comment.

Diverse responses were expected from the open-ended questions and voluntary comments. During the analysis, the voluntary comments were categorised into seven themes in a tabulated format. In cases where the open-ended questions were more precise (as in question no 6, on environmental research on hazards), responses were included in the associated multiple-choice table, with an extension to the conventional table format (Annexure 5).

### 3.1.2 *Assumptions and Terminology*

In the entire questionnaire process, the word “mining company” refers primarily to “enterprises” engaged in coal-mining operations which is the largest employer category in the eMalahleni district. However, the term did not preclude respondents<sup>8</sup> from associating the questions with other polluting industries in the region, specifically large steel smelters and power stations.

An assumption was made regarding the availability of information. It is believed that once information exists within mining companies, such information will disseminate to households in the larger community (third-party relationships). Therefore, if formal information or education is passed down in the workplace, parents and responsible persons will make such vital information, especially information relating to hazards associated with coal and coal combustion known to members of their households. This knowledge will then gradually get into the public domain. Therefore, the unemployed and the employed in different public sectors will partially assimilate this information through social interactions over time.

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<sup>8</sup> “Respondents” in this document refers to those who completed the questionnaire units and added voluntary comments, whilst “interviewees” refers to the six people who were interviewed by the researcher.



### 3.1.3 *Pilot-testing and Refining the Questionnaires and Administration Technique*

A pilot project of mostly multiple-choice and a few open-ended questions was administered in selected schools and the community prior to the main data collection process. A section consisting of five questionnaires (on health and safety) was combined as a set per respondent. The pilot project was intended to assess the community's willingness and interest to participate in the research and to respond to the questionnaires; the convenience to respondents in terms of the time taken to complete a set of five questionnaires; the eligibility of the respondents, and their ability to respond independent of the researcher's promptings or further explanations.

The pilot project revealed the following results: the sample questionnaires were not palatable to most respondents, that is, the language structure was not easily understandable to many respondents at the first reading of the questionnaire. Some respondents were unwilling to identify themselves by name. Respondents took different lengths of time to complete the set of questionnaires. Most respondents completed only the first three questionnaires to their best ability; evidence of fatigue and boredom was apparent after the first three questionnaires. The above lessons were taken into account when refining the final questionnaire.

Based on the outcome of the pilot project, the following amendments were made, where the questionnaire structure was modified. The number of questionnaires per respondent was reduced to two, randomly compiled. The language was simplified. Personal identification of respondent by name was categorised as being secondary information and the respondents were assured of privacy. The time factor was revised to suit the completion of two questionnaires, with an average completion time of five to ten minutes per questionnaire. It was envisaged that each respondent would take not more than twenty minutes to complete the two questionnaires. No respondent was required to complete more than two questionnaires.

During the actual questionnaire administration process, the random grouping of two questionnaires per respondent provided a further advantage when dealing with the learners, by avoiding cross-communication. In the community, the use of randomised sets of two questionnaires per respondent was maintained, even though the consideration of independence was less of an issue.



The two questionnaires per respondent sampling strategy required fewer questions per respondent and the opportunity to sample a larger number of respondents to achieve the targeted number of responses per question. A targeted number of 250 to 300 completed and usable questionnaires was intended per section, though some sections were over-sampled, resulting in an unequal number of responses per section.

#### 3.1.4 *Administration of Questionnaires*

The following preparatory steps were taken before administering the questionnaires. The researcher could not speak the main ethnic Zulu language of the community. Therefore the researcher arranged for himself to be accompanied by an interpreter for all interactions in the community. Administrative considerations also had to be dealt with. Permission needed to be obtained. The Mayor's Office (eMalahleni Municipality) and the Department of Education each issued a letter, accepting the research title; the research requirements, and approving the content as being suitable for research in the district. These letters officially paved the way into the community and schools for the administering of the questionnaires.

Different approaches were used for schools and the general community. School principals were approached with these endorsement letters and a responsible person was assigned to guide and assist in the administration process within each school. No further permission was required. Questionnaires were administered to learners and educators during school hours. Everyone in the accepted grades was allowed to participate and only the selective criteria, that are age and duration of residence, could exclude anyone from the research.

A door-to-door approach was used in the community. In some cases a few community elders were approached while they were socialising with friends. No endorsement letters were required for the community-based research. The interpreter was very helpful. She greeted potential respondents in their home language and followed the greeting by a short introduction of the research. Thereafter the interpreter asked whether any members of the community present would like to participate in the research by completing the questionnaires.

This process took place on week days during working hours, thus excluding most officially employed, and perhaps more literate, members of the community. This explains the low response rate from *employed members* of the community surveyed. The same

questionnaire was administered during weekday afternoons to community dwellers and targeted individuals, such as the local municipal councillors and mine-workers. Community participation was voluntary.

Both the schools and the community were interested, rather than being hostile towards the research. However, the schools were more enthusiastic. The learners were often noisy after completing and submitting their questionnaire units. The learners were not interested in receiving any form of feedback from the research. In contrast, school administrators, teachers, ward councillors, the municipality and most community dwellers who participated in the research process indicated their willingness to receive feedback after the research had been completed.

Structured questionnaires were administered through the community and schools of eMalahleni. Areas covered included the suburbs of Clewer, KwaGuqa, Extension 1 to 10, Zone 1 to 4, Vosman, Ackerville and Lynville (all predominantly black-occupied, lower socio-economic areas) (Figure 3). There were four returns from eMalahleni municipal officials.

The questionnaires produced a range of inputs, some relevant, others not. The multiple-choice questionnaire responses were straight forward, while the open-ended question responses and voluntary comments provided were diverse.

The multiple-choice and open-ended question responses and voluntary comments were captured on an Excel® spread sheet and the condensed results by section heading (Table 5) are presented in Table 6.

Each section heading was further classified into sub-headings as in Tables 7, 8, 9 and 10. The voluntary comments varied greatly; some were relevant to the specific topic interrogated whilst others were not. No voluntary comment was discarded based on relevance.

Based on the sum, complexity and range of inputs from voluntary comments, information obtained were classified into themes. Seven themes were identified from the voluntary comments and inputs were categorised according to the themes. The themes arrived at were determined by the type of comment input response or questions posed.





The themes were:

- (i) causes harm;
- (ii) causes sickness;
- (iii) diseases experienced (for example, tuberculosis, asthma, other);
- (iv) lack of education on risk;
- (v) perceived mining company/municipal negligence;
- (vi) other information not covered; and
- (vii) lack of information and awareness.

The categorised data inputs are tabulated and also represented as percentages in Annexure 5.

### 3.1.5 *Questionnaire Screening and Validation*

The method of data collection was random selective – random in the sense that everyone within the community could participate, and selective in the criteria for acceptability of questionnaire units. The random-selective method was also applied in the schools sampled. Only senior school learners in Grades 10 and 11, of 17 years and older were permitted to participate in the research. Teachers, supporting staff and principals were also allowed to participate. Grade 12 pupils were exempted from participating to avoid educational disruption, as they were preparing for their final examinations. In addition, *all* participants in the research needed to have resided in the area for a minimum of three years.

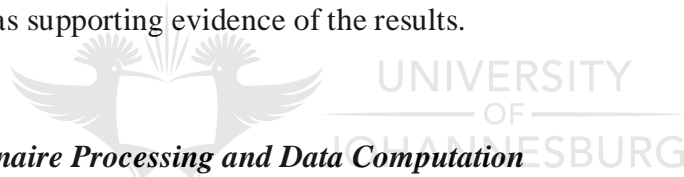
After completion, questionnaires were screened for adherence to the pre-determined guidelines, and non-compliant forms were eliminated from further consideration. The compliance fields related to: *years of residence* (a minimum of three years); *age* (a minimum of 17 years); *position held/occupation* (was compulsory). Missing information in any of these fields disqualified a questionnaire.

### 3.1.6 *Other Data Collection Methods*

Data was also collected through observations during site visits; voluntary comments, individual interviews, photographic images, and a plenary assembly question-and-answer session, referred to as a “focus group” discussion. Voluntary comments were the respondent’s personal remarks made at the bottom of each questionnaire. They were mostly grievances or information based on personal experiences in the community not

covered in the questionnaire. Information obtained from multiple-choice questionnaires, open-ended questions and voluntary comments are presented quantitatively (Annexure 5). Data from multiple-choice questionnaire responses was given values, manipulated and presented in Chapter 4, comparing the responses from the learners and the general population.

Individual interviews were conducted with selected members of the community, while a focus group discussion was held with a targeted audience, composed solely of the municipal ward councillors and chaired by the Speaker of the Municipality. Individual interviews and a focus group discussion were held concurrently with questionnaire exercises. Results from the focus group discussion and individual interviews were integrated in Chapter 5 (Results). Inputs from the open-ended question responses, voluntary comments, individual interviews and the focus group discussion served as the “voice” of the community alongside the quantitative multiple-choice data. Photographic images of the state of the bio-physical environment and prevailing hazards which surround the community taken during field observations are included in Chapter 6 (Interpretation and Discussion) as supporting evidence of the results.



### 3.1.7 Questionnaire Processing and Data Computation

An estimated 3 395 respondents completed two questionnaires apiece, totalling 6 790 completed, validated and usable questionnaires. Included on the usable questionnaires were 650 voluntary comments. The questionnaires were divided into four broad headings (Table 6). A total of 464 questionnaires were rejected for not meeting one or more criteria as set out in Section 3.1.5.

**Table 6: Overall responses by category from validated questionnaires and voluntary comments**

	Health and Safety	Disaster Preparedness and Awareness Response	Strategic Environmental Management Decisions/ Planning	Environmental Legal Application and Compliance	Total
<b>Questionnaires</b>	2 262	1 866	1 287	1 375	6 790
<b>Comments</b>	186	138	196	128	650
<b>Number of equivalent completed sections</b>	452	467	257	275	357

### 3.2 Summary Statistics

Information collected on the various aspects was entered into an Excel® spread sheet. The Excel® spread sheet consisted of columns and rows. The columns contained the values of “Yes”, “No”, “Sometimes”, “Other” and “Abstain”. If a respondent failed to provide any response to the four answer options, that respondent was deemed to have “Abstained” from responding to a question. The rows contained question numbers. Responses were arranged per question number and per value response. Totals were calculated for each question number, and tabulated per section heading. Mean and standard deviation were calculated based only on the “Yes”, “No” and “Sometimes” responses; “Other” and “Abstain” (responses) were excluded (Annexure 5). Typically, these latter two categories represented fewer than 10 % of the responses, so their exclusion is not considered to bias the results materially. The following values were given: “Yes” = +1, “Sometimes” = 0 and “No” = -1, from which the statistical significance was calculated to determine the mean and standard deviation.

Four broad sections and 19 sub-sections were covered, consisting of Health and Safety; Disaster Preparedness and Awareness Response; Strategic Environmental Management Decisions/ Planning, and Environmental Legal Application and Compliance (Table 6).

Five sub-sections were covered on Health and Safety category. These five sub-sections provided 2 262 usable responses (that is, one question per sub-section) and 186 voluntary comments. The sub-section responses validated represent N = 452 completed questionnaires. Data are distributed per sub-section heading in Table 7.

**Table 7: Overall input on health and safety questionnaire and voluntary comments**

	Dust Exposure	Noise and Vibration Exposure	Temperature and Heat Exposure	Coal-mining and Coal-processing Gases	Health and Hazard Exposure	Total
<b>Questionnaires</b>	500	500	490	500	272	2 262
<b>Comments</b>	56	43	43	26	18	186

Four sub-sections were covered on Disaster Preparedness and Awareness Response category. The four sub-sections provided 1 866 responses and 138 voluntary comments.



The sub-section responses validated are equivalent to N = 467 completed questionnaires. The data are distributed per sub-heading in Table 8.

**Table 8: Overall input on disaster preparedness and awareness response and voluntary comments**

	Coal Fires and Fire-fighting Equipment	Explosives	Air-quality Monitoring	Underground Surveillance	Total
Questionnaires	476	445	475	470	1 866
Comments	41	35	35	27	138

Five sub-sections were covered on Strategic Environmental Management Decisions/ Planning category, which yielded 1 287 responses and 196 voluntary comments. The responses validated are equivalent to N = 257 completed questionnaires. Data are distributed per sub-heading in Table 9.

**Table 9: Overall input on strategic environmental management decisions/planning and voluntary comments**

	Environmental Hazards and Planning Decisions	Environmental Research on Hazards	Equipment for Hazard Management	Monitoring and Control Systems for Hazards	Improve Risk and Awareness Practices	Total
Questionnaires	283	271	261	238	234	1 287
Comments	40	50	37	38	31	196

Five sub-sections covered in Environmental Legal Application and Compliance category provided 1 375 and 128 voluntary comments. The sub-section responses validated represent N = 275 completed questionnaires. Data are distributed per sub-section heading in Table 10.

The summary statistics for each of the four sections categories and 19 sub-sections are presented in Annexure 5.

**Table 10: Overall input on environmental legal application and compliance and voluntary comments**

	Environmental Legislation on Hazards	National Environmental Management Act (RSA 1998)	Environment Conservation Act (RSA 1989)	Minerals Act (RSA 1991)	Mineral and Petroleum Resources Development Act (RSA 2002)	Total
Number of questionnaires	199	277	275	320	304	1 375
Comments	23	28	19	30	28	128

### 3.3 Individual Interviews and the Focus Group Discussion

Self-administered, semi-structured interviews were conducted in English on selective criteria and a brief note of the interviewee's response taken during the interview. The notes taken during the interviews were transcribed in detail the same evening so as not to lose essential detail and clarity.

Interviews were held with six selected members of the community, who were older than 25 years (Annexure 8). These interviewees had some influence in local government, industry or the local community. Two groups of people were selected for the exercise: (i) three members of the community who reside there permanently, and (ii) three members of the community who do not reside within the municipality but who work within the area.

The interviews were semi-structured, although the questions were not presented in a specific order, as the nature and type of response may have halted or triggered further questions on particular issues. Interviews were conducted in a relaxed mode during pre-arranged meetings, in between other site research. Interviews were undertaken at different times of the year and interviewees were not aware of each other or each other's responses prior to being interviewed. Interviews were not conducted anonymously, therefore the interviewee's personal details were taken down prior to the commencement of the interview and they were assured that their privacy would be respected when the results of the research were documented.

Personal details requested were (Annexure 8): *full name and surname, contact number, title, position held/occupation, duration of service (whether employed or elected), age, duration of residence in the community, extra-curricular activities, any awards and membership of any organisation* were all noted. Other aspects noted were *place of*



*interview, date of interview, commencement time, duration of the interview and closing time.* Only one interview lasted more than 30 minutes.

The three permanent resident members of the community who were interviewed were: (i) the Councillor of Ward 9 (age 26 years, duration of residence eight years) and his first term in office as a ward councillor, (ii) the *Basa njengo Magogo* project coordinator, Marketing Director and a Nedbank Capital Green Mining Award winner for 2007 (age 40 years, duration of residence four years), and (iii) a community elder, research assistant and interpreter (age 60 years, duration of residence 27 years).

The three interviewees who worked within the municipality, but did not reside there, were: (i) the Mayor of the municipality (age 46 years, duration in office six years); (ii) the Speaker of the municipality (age 56 years, duration in office 14 years), and (iii) the Anglo Coal Environmental Project Officer and senior environmental research student at the University of Johannesburg (age 45 years, duration of employment at Anglo Coal 10 years).

The Speaker of the municipality is the only respondent who was interviewed twice: the first time on the occasion of the inauguration of an air-quality monitoring caravan (in Vosman township), and the second time was almost a year later in the Mayoral Parlour. Anglo Coal Environmental Project Officer was interviewed on the day of the inauguration of the air-quality monitoring caravan. Neither interview at the caravan site was semi-structured, planned or arranged as they took place on the “spur of the moment” at the event. However, both interviews yielded insightful information, which is presented in Chapter 5.

A meeting scheduled on the 05 May 2007, in the Municipal Council offices consisted of the ward councillors at a plenary meeting of Council, hereafter called a “focus group discussion”. The focus group discussion was intended to assess the level of hazard awareness in the community through community representatives. The session lasted for an hour. The attendees were twenty councillors from various wards within the Municipality and the session was chaired by the Speaker (Annexure 8). Those who did not attend were the Mayor and the eMalahleni Public Relations Officer notwithstanding the fact that the Public Relations Officer had convened and coordinated the meeting. Also absent was the Secretary of the Mayor’s parlour (Annexure 8). The session started with a brief introduction and reason for the extraordinary session, during which the guest speaker

(namely, the researcher) was introduced and gave a twenty-minute presentation on the purpose of the research. It was followed by questions and answers as outlined in the agenda handout.

The question-and-answer session followed immediately after the presentation. Questions were asked in groups of five at a time and then attempted answers provided. However, the session became the reverse of its intent: instead of the researcher questioning the councillors or municipality, as was initially intended, the reverse happened. The Speaker attempted to answer some of the questions, but later halted and postponed the session. In effect, the researcher's questions intended for the councillors were not asked. Most questions asked revolved around the economy, the environmental and social situation of the municipality and the community. Although no guideline rules on anonymity were provided, the councillors did not provide personal details. Therefore, the councillors were identified sequentially as Speaker 1 and Speaker 2.

The full insight of voluntary comments, individual interviews and the focus group discussion are presented (in *Italics*) in Chapter 5, to serve as the people's voice. The qualitative responses in Chapter 5 support the quantitative evidence and scientific argument in Chapter 4.

### 3.4 Conclusion

This chapter outline the data collection techniques through multiple-choice, open ended questions, voluntary comments, individual interviews, a focus group discussion and the use of photographic images. The chapter illustrates how the research tools were structured, pre-requisite for the administration of questionnaires, the administration of questionnaire process and the use of a pilot project. A step-to-step progress from the pilot project, why the pilot project was necessary, amendments made after the pilot project and the effective implementation of the research tools. The acquisition of raw data through questionnaires and voluntary comments, tabulated and presented on an excel® spread sheet. The chapter concludes on how this raw data will be integrated meaningfully in subsequent chapters.



## **Chapter 4: DATA ANALYSIS AND PRELIMINARY RESULTS**

*This chapter contains an analysis and an interpretation of the quantitative information presented in Chapter 3. It describes the manipulation of the information to determine the awareness level of the respondents through a comparative approach between the learners and the general population. Preliminary results are presented in tables as percentages, average scores and a t-test for variance. Figures are represented in bar graphs and pie charts. At the end of each sub-section, a brief discussion is given in relation to the study objectives.*

### **4.1 Overview of Information Manipulation Techniques**

As indicated in Chapter 3, the following analytical techniques were applied. Scales of values were used to determine values per response, mean and standard deviation (std dev). Numerical values were assigned: “Yes” = +1, “Sometimes” = 0, and “No” = -1, generating a scale that ranged from +1 to -1 (Annexure 5). A score of +1 indicates a “strong agreement” across the entire population. Conversely, a score of -1 represents a “strong disagreement” across the entire population. Scores close to zero, with a large standard deviation indicate divergence in opinions, whereas scores close to zero with a small standard deviation signify neither a strong view for or against the subject interrogated. The results are presented in Chapter 5 using categorical values and t-test variance. Results are presented per section.

Colour codes are used on the tables to illustrate questions assessing similar aspects from the general to the specific. For example, questions assessing common topics like “awareness” are given the same colour code in a particular table. For the sake of consistency and ease of interpretation, the same colour-coding scheme is used throughout all the tables presented in this chapter. All significant differences are at  $p \leq 0.05$ .

The questionnaire responses were split into two groups – the *learners* and the *general population*. The preliminary results are presented as percentages per sub-section (Annexure 6). The purpose for classifying these questionnaire statistics was to make an analysis based on the respondents’ level of education. It is hypothesised that the older generation is not well informed about current developments such as the term *sustainable*



*development*, a term commonly used in our present-day society. Therefore, it was anticipated that the learners would be more informed and aware than the older members of the community regarding the hazards associated with mining and environmental degradation. It was further assumed that mining companies use the term *sustainable development* in a mining context and not necessarily in the same context as the current education curriculum<sup>9</sup>.

## 4.2 Overview of Responses to Questionnaires

The questionnaires probe health and safety; disaster preparedness and awareness response; strategic environmental management decisions/planning, and environmental legal application and compliance. Many factors are responsible for the state of the community responses – for example, poverty, illiteracy, income level and employment status. These factors have a direct influence on the level of awareness and the free flow of information in the study area. Assessment in this research is based on the awareness of coal hazards – from coal mining to coal burning – and policy actions. Other aspects relating to awareness assessed include education regarding the hazards of coal, the availability of environmental information, environmental perceptions and changes in environmental practice.

“Health and safety” was covered in five sub-sections (Table 7) and is analysed separately for the learners and general population.

## 4.3 Health and Safety

### 4.3.1 *Dust Exposure*

#### 4.3.1.1 Learners

The data analysed (Table 11) show that 66 % of the learners are aware of dust coming from the mines. Of this 66 %:

- 82 % are aware of its source (most probably from mining activities)

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<sup>9</sup> In the mining environment, “sustainable development” is used as a holistic term to include all available factors of production and with greater emphasis on human health, whereas in the school curriculum the term “sustainable development” is limited to the awareness of the human environment.

- 29 % are aware that a mining company<sup>10</sup> carries out dust control in the community
- 83 % are aware of the hazards of coal-dust exposure
- 34 % agree that a mining company has educated their community on the hazards of coal-dust
- 39 % agree the municipality has educated their community on the hazards of coal-dust
- 39 % obtained information on coal-dust from a mining company
- 66 % are interested in knowing about company coal-dust control measures
- 73 % acknowledged the existence of clinical survey/ reports conducted on coal-dust-related diseases, while
- 58 % are of the opinion that mine workers are informed about coal-dust and related diseases.

#### 4.3.1.2 General Population

The data analysed (Table 11) show that 72 % of the general population are aware of dust coming from the mines. Of this 72 %:

- 70 % are aware of its source (most probably from mining activities)
- 42 % are aware that a mining company carries out dust control in the community
- 74 % are aware of the hazards of coal-dust exposure
- 29 % agree that a mining company has educated their community on the hazards of coal-dust
- 34 % agree the municipality has educated their community on the hazards of coal-dust
- 43 % obtained information on coal-dust from a mining company

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<sup>10</sup> “Mining company” is used in a specialised sense to indicate in a general term mining extractive industries, the likely employer of local labour and probably the source of mining-related pollution hazards. The commonly used phrase “mining industry” is related to a broader corporate spectrum of extraction, beneficiation, financial and administration. The current study focuses on localised implementation and understanding of sustainability practices in mining communities.

- 72 % are interested in knowing about company coal-dust control measures
- 46 % acknowledged the existence of clinical reports conducted on coal-dust-related diseases, while
- 57 % are of the opinion that mine workers are informed about coal-dust and related diseases.

**Table 11: Questionnaire responses on dust exposure**

Academic ==> LEARNERS														
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	Q9=3	Q10=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3														
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
Count Yes	106	87	3	106	87	31	88	36	41	41	106	77	93	
Count Sometimes	27	39	<3	54	19	75	18	70	65	65	54	29	67	
Count No	24	29	Checksum	160										
Count Others	3	5	3	66%	82%	29%	83%	34%	39%	39%	66%	73%	58%	
Check Sum	160		<3	34%	18%	71%	17%	66%	61%	61%	34%	27%	42%	
				Fraction of entire population		69%								
GENERAL POPULATION														
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8=3	Q9=3	Q10=3	
Count Yes	76	53	3	76	53	32	56	22	26	33	76	35	60	
Count Sometimes	17	18	<3	29	23	44	20	54	50	43	29	41	45	
Count No	9	28	Checksum	105	76									
Count Others	3	6	3	72%	70%	42%	74%	29%	34%	43%	72%	46%	57%	
Check Sum	105	210	<3	28%	30%	58%	26%	71%	66%	57%	28%	54%	43%	
				Fraction of entire population		61%								
				100%		100%	100%	100%	100%	100%				
RATIO Academic: General				0.92	1.18	0.69	1.13	1.17	1.13	0.89	0.92	1.58	1.02	
				Significant difference at p = 0.05		Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes

#### 4.3.1.3 Comparing responses from the Learners and the General Population

There are significant differences at the  $p = 0.05$  level for the standard error between the learners and the general population for Questions 1, 2, 3, 4, 7, 8 and 9, which deal with:

- awareness of dust coming from mines
- awareness of dust within the community attributed to mining activities
- awareness that a mining company carries out dust control within the mining community
- awareness of the hazards of coal-dust exposure
- acknowledgement of the existence of reports or information on dust control provided to their community by a mining company
- interest in knowing about coal-dust control by a mining company, and
- acknowledgement of the situation that there are clinical surveys/reports on coal-dust and related diseases within the community.

#### 4.3.1.4 Discussion

Although most of the respondents are aware of the effects of coal-dust in a general sense, the learners are more aware of coal-dust and its health implications than their parents. This explains why there is a greater risk of exposure to the hazards of coal-dust in the community as parents are not properly aware, educated and informed about the hazards of coal-dust exposure and related diseases. Therefore, they cannot effectively educate, inform, advise and protect their children. When parents cannot assess a hazard, they evidently cannot effect disaster-preparedness measures. This is explored further using other techniques in Chapters 5 and 6.

### 4.3.2 *Noise and Vibration Exposure*

#### 4.3.2.1 Learners

The data analysed (Table 12) show that 65 % of the learners are aware of the hazards of noise and vibration. Of this 65 %:

- 65 % agree that they sometimes hear noise from company mining activities
- 38 % agree that the noise is intrusive (loud) and obstructive to hearing
- 22 % agree that their community has received education on the hazards of noise and vibration from a mining company
- 26 % agree that their community has received education on the hazards of noise and vibration from the municipality
- 28 % acknowledge that information has been provided to the community on the hazards of noise and vibration from mines
- 57 % agree that the mine workers are informed about the hazards of noise and vibration during mining
- 58 % confirm that mine workers are sometimes tested for noise and vibration related diseases, while
- 77 % of the learners are interested in knowing about mining company noise and vibration control measures.

### 4.3.2.2 General Population

The data analysed (Table 12) show that 70 % of the general population are aware of the hazards of noise and vibration. Of this 70 %:

- 65 % agree that they sometimes hear noise from company mining activities
- 47 % agree that the noise is intrusive (loud) and obstructive to hearing
- 23 % agree that their community has received education on the hazards of noise and vibration from a mining company
- 25 % agree that their community has received education on the hazards of noise and vibration from the municipality
- 22 % acknowledge that information has been provided to the community on the hazards of noise and vibration from mines
- 56 % agree that the mine workers are informed about the hazards of noise and vibration during mining
- 50 % confirm that mine workers are sometimes tested for noise and vibration related diseases, while
- 74 % of the general population are interested in knowing about mining company noise and vibration control measures.

**Table 12: Questionnaire responses on noise and vibration exposure**

Academic ==> LEARNERS												
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	Q9=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3												
Count Yes	198	197	3	Q1 198	Q2 197	Q3 116	Q4 68	Q5 78	Q6 84	Q7 175	Q8 176	Q9 235
Count Sometimes	52	62	<3	107	108	189	237	227	221	130	129	70
Count No	55	46	Checksum	305								
Coount Others	0	0	3	65%	65%	38%	22%	26%	28%	57%	58%	77%
Check Sum	305	305	<3	35%	35%	62%	78%	74%	72%	42%	42%	23%
Fraction of entire population				35%								
GENERAL POPULATION												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Count Yes	130	121	3	130	121	87	43	46	41	103	93	136
Count Sometimes	24	36	<3	55	64	98	142	139	144	82	92	49
Count No	29	26	Checksum	185								
Count Others	2	2	3	70%	65%	47%	23%	25%	22%	56%	50%	74%
Check Sum	185	185	<3	30%	35%	53%	77%	75%	78%	44%	50%	26%
Fraction of entire population				35%								
				100%	100%	100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				0.92	0.99	0.81	0.96	1.03	1.24	1.03	1.15	1.05
Significant difference at p = 0.05				Yes	No	Yes	No	No	Yes	No	No	Yes

#### **4.3.2.3 Comparing responses from the Learners and the General Population**

There are significant differences at the  $p = 0.05$  level for the standard error between the learners and the general population for Questions 1, 3, 6 and 9, which deal with:

- awareness of the hazards of noise and vibration
- acknowledgement that the noise is intrusive (loud) and obstructive to hearing
- acknowledgement that information has been provided to the community on the hazards of noise and vibration from mines, and
- the interest to know about company noise and vibration control measures.

#### **4.3.2.4 Discussion**

The significant differences between the learners and the general population regarding the awareness of noise and vibration as a hazard are an indication of poor information and communication within the community. The general population is slightly more aware and better informed than the learners are. Despite the foregoing, the general population is not in a good position to educate, inform, advise and protect their children, especially the younger ones who are unaware of this hazard. This situation is further confirmed by examining other data in Chapters 5 and 6.

### **4.3.3 *Temperature and Heat Exposure***

#### **4.3.3.1 Learners**

The data analysed (Table 13) show that 54 % of the learners are aware of temperature and heat as hazards. Of this 54 %:

- 48 % sometimes feel an abnormal temperature and heat increase likely as a result of mining processes
- 19 % agree that a mining company has educated their community on the hazards of temperature and heat exposure
- 24 % agree that the municipality has educated their community on the hazards of temperature and heat exposure
- 31 % have received information on temperature and heat as a hazard

- 48 % agree that mine workers are informed about the hazards of temperature and heat exposure
- 55 % agree that mine workers are tested for temperature and heat-related diseases, while
- 77 % are interested in knowing about mining company temperature and heat control measures.

#### **4.3.3.2 General Population**

The data analysed (Table 13) show that 61 % of the general population are aware of temperature and heat as a hazard. Of this 61 %:

- 54 % sometimes feel an abnormal temperature and heat increase likely as a result of mining processes
- 18 % agree that a mining company has educated their community on the hazards of temperature and heat exposure
- 25 % agree that the municipality has educated their community on the hazards of temperature and heat exposure
- 30 % have received information on temperature and heat as a hazard
- 53 % agree that mine workers are informed about the hazards of temperature and heat exposure
- 59 % agree that mine workers are tested for temperature and heat-related diseases, while
- 80 % are interested in knowing about mining company temperature and heat control measures.

**Table 13: Questionnaire responses on temperature and heat exposure**

Academic ==> LEARNERS												
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Count Yes	170	152	3	170	152	60	77	99	151	174	244	
Count Sometimes	52	88	<3	145	163	255	238	216	164	141	68	
Count No	75	66	Checksum	315								
Count Others	18	9	3	54%	48%	19%	24%	31%	48%	55%	77%	
Check Sum	315	315	<3	46%	52%	81%	76%	69%	52%	45%	22%	
Fraction of entire population												
GENERAL POPULATION												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Count Yes	103	91	3	103	91	31	42	50	90	99	136	
Count Sometimes	26	38	<3	66	78	138	127	119	79	70	33	
Count No	38	36	Checksum	169								
Count Others	2	4	3	61%	54%	18%	25%	30%	53%	59%	80%	
Check Sum	169	169	<3	39%	46%	82%	75%	70%	47%	41%	20%	
Fraction of entire population												
				100%	100%	100%	100%	100%	100%	100%	100%	
<b>RATIO Academic: General</b>				0.89	0.90	1.04	0.98	1.06	0.90	0.94	0.96	
Significant difference at p = 0.05				Yes	No	No	No	No	Yes	No	No	

#### 4.3.3.3 Comparing responses from the Learners and the General Population

There are significant differences at the  $p = 0.05$  level for the standard error, between the learners and the general population for Questions 1 and 6, which deal with:

- awareness of temperature and heat as hazards, and
- acknowledgement that mine workers are informed about the hazards of temperature and heat exposure.

#### 4.3.3.4 Discussion

The learners constitute most of the literate community, yet only 54 % are aware of the hazards of temperature and heat exposure as a hazard as opposed to 61 % of the general population. This highlights a problem. If 54 % of the senior learners, although educated, are aware but less informed than the general population, it poses a question about the knowledge of the 46 % who are not aware and the massive number of junior learners who are probably not aware and were not able to participate in this research.

The same cannot be said of the general population which is more aware, although less educated. There still remains a problem, however, with the remaining 39 % who cannot advise, educate and protect their children from impending danger of temperature and heat. The complexity of the situation is confirmed by the high input regarding ‘*interest to know more about mining company temperature and heat control measures*’ and the fact



that a great number of respondents agree that mine workers are better aware and tested for temperature and heat-related diseases. This is alluded to again in Chapter 5.1.1.

#### 4.3.4 *Coal-Mining and Coal-Processing Gases*

##### 4.3.4.1 Learners

The data analysed (Table 14) show that 62 % of the learners are aware of gases generated during coal-mining and coal-processing operations. Of this 62 %:

- 31 % agree that a mining company has educated the community about the existence of various coal-mining and coal-processing gases
- 29 % agree that the municipality has educated the community about the existence of various coal-mining and coal-processing gases
- 38 % agree that they have received information on the existence of various coal-mining and coal-processing gases
- 92 % agree they are aware of the hazards of coal-mining and coal-processing gases
- 58 % agree that they are aware that mine workers are informed about the various coal-mining and coal-processing gases
- 51 % agree that mine workers are informed about the hazards of the various coal-mining and coal-processing gases
- 57 % agree that mine workers are tested for various coal-mining and coal-processing gas-related diseases
- 20 % agree that they have been tested for coal-mining and coal-processing gas-related diseases, while
- 73 % are interested in knowing how a mining company manages the hazards of coal-mining and coal-processing gases.

##### 4.3.4.2 General Population

The data analysed (Table 14) show that 72 % of the general population are aware of gases generated during coal-mining and coal-processing. Of this 72 %:

- 29 % agree that a mining company has educated the community about the existence of various coal-mining and coal-processing gases
- 27 % agree that the municipality has educated the community about the existence of various coal-mining and coal-processing gases
- 29 % agree that they have received information on the existence of various coal-mining and coal-processing gases
- 72 % agree they are aware of the hazards of coal-mining and coal-processing gases
- 53 % agree that they are aware that mine workers are informed about the various coal-mining and coal-processing gases
- 47 % agree that mine workers are informed about the hazards of the various coal-mining and coal-processing gases
- 49 % agree that mine workers are tested for various coal-mining and coal-processing gas-related diseases
- 23 % agree that they have been tested for coal-mining and coal-processing gas-related diseases, while
- 71 % are interested in knowing how a mining company manages the hazards of coal-mining and coal-processing gases.

**Table 14: Questionnaire responses on coal-mining and coal-processing gases**

Academic ==> LEARNERS																
			Criteria	Q1=3	Q2a=3	Q2b=3	Q2c=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	Q9=3	Q10=3	Q11=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3																
				Q1	Q2a	Q2b	Q2c	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Count Yes	219	352	3	219	352	352	352	108	103	132	201	205	181	200	69	256
Count Sometimes	41	0	<3	133	0	0	0	244	249	220	18	147	171	152	283	96
Count No	75	0	Checksum	352												
Count Others	17	0	3	62%	100%	100%	100%	31%	29%	38%	92%	58%	51%	57%	20%	73%
Check Sum	352	352	<3	38%	0%	0%	0%	36%	71%	63%	8%	42%	49%	43%	80%	27%
Fraction of entire population																
GENERAL POPULATION																
				Q1	Q2a	Q2b	Q2c	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Count Yes	97	135	3	97	135	135	135	39	36	39	70	71	64	66	31	96
Count Sometimes	4	0	<3	38	0	0	0	96	99	96	27	64	71	69	104	39
Count No	17	0	Checksum	135												
Count Others	17	0	3	72%	100%	100%	100%	29%	27%	29%	72%	53%	47%	49%	23%	71%
Check Sum	135	135	<3	28%	0%	0%	0%	71%	73%	71%	28%	47%	53%	51%	77%	29%
Fraction of entire population																
				100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				0.89				1.06	1.1	1.3	1.27	1.11	1.08	1.16	85%	102%
			Significant difference at p = 0.05	No				Yes	No	Yes	Yes	Yes	Yes	Yes	No	No

#### 4.3.4.3 Comparing responses from the Learners and the General Population

There are significant differences at the  $p = 0.05$  level for the standard error between the learners and the general population for Questions 3, 5, 6, 7, 8 and 9, which deal with:

- acknowledgement that a mining company has educated the community about the existence of coal-mining and coal-processing gases
- acknowledgement that information has been provided to the community about the existence of coal-mining and coal-processing gases
- awareness of the hazards of coal-mining and coal-processing gases
- acknowledgement that mine workers are informed about the various coal-mining and coal-processing gases
- acknowledgement that mine workers are informed about the hazards of the various coal-mining and coal-processing gases, and
- acknowledgement that mine workers are tested for coal-mining and coal-processing gas-related diseases.

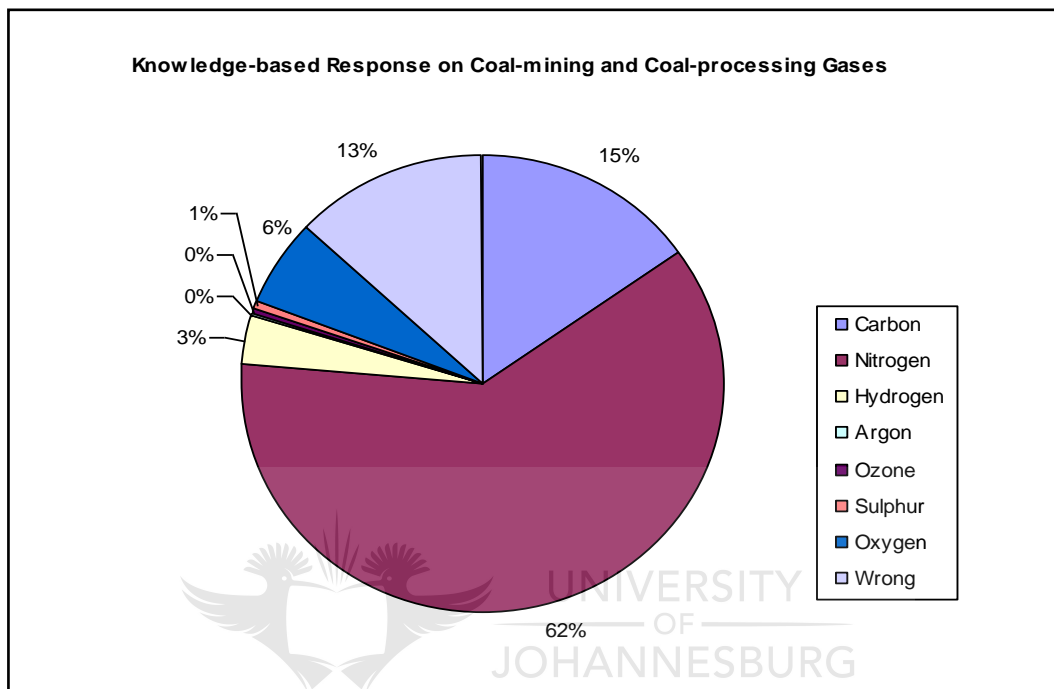
#### **4.3.4.4 Discussion**

The responses point to a looming disaster in the community. Though learners and the general population are seemingly aware of gases generated during coal-mining and coal-processing, and the hazards of these gases, there is still a problem at the community level. Most community dwellers are not aware of specific coal-mining and coal-processing gases. Only a minority (<38 %) of the respondents can claim awareness through a valid source of information. Neither a mining company nor the municipality have informed and educated the community sufficiently (<40 %). Though the community opinion holds that mine workers are informed and educated about, and tested for, coal-mining and coal-processing gas-related diseases, they constitute a minority of the total population. Therefore, their impact on the community is not felt proportionately. More evidence is drawn from the responses to an open-ended question and other data sources in Chapters 5 and 6.

#### **4.3.4.5 Knowledge-based responses**

Evidence of lack of education and poor communication between stakeholders is demonstrated from the responses to the open-ended question. The result shows that the respondents are *not* able to identify by name any toxic gases known to the community. The respondents (62 %) cited nitrogen as being the most well known of these gases, followed

by carbon<sup>11</sup> (to include carbon monoxide and carbon dioxide) (15 %) and a handful of wrong responses (13 %) (Figure 8). No-one identified an example of a pollutant gas (for example, CO, CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>2</sub>). Methane (CH<sub>4</sub>), which is the most common gas produced during coal-mining, coal-processing and coal-combustion processes, was also not mentioned.



**Figure 8: Responses to open-ended (knowledge-based) question on known gases in the community**

#### 4.3.5 Health and Hazard Exposure

##### 4.3.5.1 Learners

The data analysed (Table 15) show that 57 % of the learners are aware of coal-related health hazards. Of this 57 %:

- 38 % agree that they have suffered from a coal-related illness

<sup>11</sup> C, CO and CO<sub>2</sub> are used interchangeably by the respondents who completed the questionnaires as their level of education did not enable them to distinguish between the solid (carbon) and the gaseous forms (carbon monoxide and/or carbon dioxide).



- 41 % agree that they know someone who has suffered from a coal-related disease
- 37 % agree that those who have suffered from any coal-related illness (41 %) may have worked at a coal-mining company
- 26 % agree that they know at least one person who has died from a coal-mining related disease, while
- 31 % are interested in knowing about the health hazards of coal and coal-related illnesses.

#### **4.3.5.2 General Population**

The data analysed (Table 15) show that 49 % of the general population are aware of coal-related health hazards. Of this 49 %:

- 17 % agree that they have suffered from a coal-related illness
- 38 % agree that they know someone who has suffered from a coal-related disease
- 16 % agree that those who have suffered from a coal-related illness (38 %) may have worked at a coal-mining company
- 11 % agree that they know at least one person who has died from a coal-mining related disease, while
- 48 % are interested in knowing about the health hazards of coal and coal-related illnesses.

**Table 15: Questionnaire responses on health and hazard exposure**

Academic ==> LEARNERS												
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	Q9=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Count Yes	104	184	3	104	184	70	184	76	184	68	47	57
Count Sometimes	21	0	<3	80	0	114	0	108	0	116	137	127
Count No	58	0	Checksum	184								
Count Others	1	0	3	57%	100%	38%	100%	41%	100%	37%	26%	31%
Check Sum	184	184	<3	43%	0%	62%	0%	59%	0%	63%	74%	69%
Fraction of entire population												
GENERAL POPULATION												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Count Yes	43	88	3	43	88	15	88	33	88	14	10	42
Count Sometimes	7	0	<3	45	0	73	0	55	0	74	78	46
Count No	38	0	Checksum	88								
Count Others	0	0	3	49%	100%	17%	100%	38%	100%	16%	11%	48%
Check Sum	88	88	<3	51%	0%	83%	0%	63%	0%	84%	89%	52%
Fraction of entire population												
				100%	100%	100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				1.11		2.23		1.1		2.32	2.25	0.65
			Significant difference at p = 0.05	Yes		Yes		No		Yes	Yes	Yes

#### 4.3.5.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error between the learners and the general population for Questions 1, 3, 7, 8 and 9, which deal with:

- awareness of any coal-related health hazards
- acknowledgement that the respondent has suffered from a coal-related illness
- acknowledgement that the respondent knows someone who may have worked at a coal-mining company
- acknowledgement that the respondent knows someone who has died from a coal-mining-related disease, and
- the interest in knowing about the health hazards of coal and coal-related illnesses.

#### 4.3.5.4 Discussion

Health and hazards are closely related. Health is highly rated in any hazard assessment. Disaster preparedness is often lacking in the social context for various reasons. The inability to assess social hazard is attributed to the gradual and cumulative nature of its impact, compared with instant incidents of natural hazards. Even where statistical information and accounting records are maintained and used, social accountability has been neglected, based on “*what cannot be measured, cannot be accounted for*”. Environmental management tools such as “Physical Environmental Management

Accounting” and “Monetary Environmental Management Accounting” are used by some companies to assess environmental impact. None of the above tools make sufficient reference to “Environmental Management and Social Accounting” (Schaltegger et al. 2003:254-291). This inability to account for environmental social conditions (social hazards) has severe long-term repercussions on the community (for example, social decay) and community health conditions.

Relating to the above, is a serious problem within the eMalahleni community, which mostly uses coal-burning and other biomass-burning, for cooking and heating. Most of the general population is not aware of the hazards of coal-burning on health. Many of the general population is not aware of common (respiratory) diseases related to coal-mining, coal-processing and coal-burning. This explains why parents are not in a good position to inform, educate and advise their children on coal hazards and related diseases. Though analysed data show that senior learners seem to know more than their parents, their response is not convincing to assure sufficient awareness in the community. Furthermore, the senior learners constitute only a fraction of the total number of learners and the total population. This indicates shortcomings that need to be addressed in the community. More evidence is drawn from the responses to the open-ended questions and other data sources in Chapters 5 and 6.

#### **4.3.5.5 Knowledge-based responses**

Due to the number of diverse inputs obtained from the open-ended questions, the information is tabulated and presented over a range of responses (Table 16). Knowledge-based responses on health and hazards show that a substantial number of the community dwellers are unable to identify a common disease associated with coal-mining and coal usage. This is evident from the number of wrong responses, with most respondents identifying *sinusitis* as the most common disease, followed by *tuberculosis* and *asthma*. Most of those who identified the said diseases had their experiences from uncles, brothers and friends. Not one respondent indicated personal experience of such a disease or experience of a parent with such a disease.

**Table 16: Knowledge-based responses on health and hazard exposure (Questions 2, 4 and 6)**

Responses	Question 2 State any coal-related disease which you know	Question 4 State any coal-related illness from which you have suffered	Question 6 State your relationship with the person
Wrong response	21	24	27
Asthma	7	6	0
Sinusitis	50	46	0
Pneumoconiosis	1	0	0
Tuberculosis	15	8	0
Bronchitis	5	4	0
Cancer	13	3	0
Coughing blood	1	6	0
Itching nose	0	1	0
Bleeding	0	2	0
Cousin	0	0	9
Neighbour	0	0	5
Uncle	0	0	15
Friends	0	0	12
Brother	0	0	12
Mother	0	0	4
Sister	0	0	2
Father	0	0	6
Grandmother	0	0	2
Grandfather	0	0	2
Aunt	0	0	2
Daughter	0	0	1
Class mate	0	0	1
I don't know	3	0	0
<b>Total</b>	<b>116</b>	<b>100</b>	<b>100</b>

#### 4.4 Disaster Preparedness and Awareness Response

Disaster preparedness is the first step in disaster management. It is only possible to put mitigation in place once awareness exists. Disaster preparedness and awareness response is possible once the causes have been established. Many factors interplay in assessing its frequency and magnitude, such as the physical, social, economic, political and technological dimensions. Therefore, disaster preparedness includes all possible measures that need to be executed to prevent a disaster developing from a physical into a social dimension. These measures include awareness response, education, availability of information and reporting, among others.



In assessing disaster preparedness and awareness response, four hazard response sub-sections were identified for this section. The hazard response sub-sections identified were: coal fires and fire-fighting equipment, air-quality monitoring, explosives and explosions, and underground surveillance.

#### 4.4.1 *Coal Fires and Fire-Fighting Equipment*

##### 4.4.1.1 Learners

The analysed data (Table 17) show that 77 % of learners are aware of coal fires (from, for example, spontaneous combustion, stock piles, and indoor fires) in their community. Of this 77 %:

- 70 % are aware of the hazard of coal fires
- 50 % are aware of mining company fire-fighting efforts
- 41 % are aware of mining company fire-fighting equipment
- 36 % have received information on fire-fighting efforts from a mining company
- 31 % agree that the municipality has informed the community on a mining company's fire-fighting efforts
- 41 % have received information from a mining company on the hazards of coal fires
- 85% are interested in knowing about the hazards of coal fires
- 86 % are interested in knowing how a mining company combats coal fires, and
- 56 % agree that mine workers in their community are aware of the hazards of coal fires.

##### 4.4.1.2 General Population

The analysed data (Table 17) show that 76 % of the general population are aware of coal fires. Of this 76 %:

- 64 % are aware of the hazard of coal fires
- 43 % are aware of mining company fire-fighting efforts

- 45 % are aware of mining company fire-fighting equipment
- 26 % have received information on fire-fighting efforts from a mining company
- 38 % agree that the municipality has informed the community on a mining company’s fire-fighting efforts
- 42 % have received information from a mining company on the hazards of coal fires
- 69 % are interested in knowing about the hazards of coal fires
- 70 % are interested in knowing how a mining company combats coal fires, and
- 84 % agree that mine workers in their community are aware of the hazards of coal fires.

**Table 17: Questionnaire responses on coal fires and fire-fighting equipment**

Academic ==> LEARNERS														
			Criteria	Q1 =3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	Q9=3	Q10=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3														
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
Count Yes	205	144	3	205	144	102	84	73	63	84	226	228	148	
Count Sometimes	21	45	<3	61	61	103	121	132	142	121	40	38	118	
Count No	29	66	Checksum	266										
Count Others	11	11	3	77%	70%	50%	41%	36%	31%	41%	85%	86%	56%	
Check Sum	266		<3	23%	30%	50%	59%	64%	69%	59%	15%	14%	44%	
Fraction of entire population														
GENERAL POPULATION														
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8=3	Q9=3	Q10=3	
Count Yes	159	101	3	159	101	69	71	42	61	66	145	146	134	
Count Sometimes	18	34	<3	51	58	90	88	117	98	93	65	64	25	
Count No	29	65	Checksum	210										
Count Others	4	10	3	76%	64%	43%	45%	26%	38%	42%	69%	70%	84%	
Check Sum	210	210	<3	24%	36%	57%	55%	74%	62%	58%	31%	30%	16%	
Fraction of entire population														
				100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
RATIO Academic: General				1.02	1.11	1.15	0.92	1.35	0.8	0.99	1.23	1.23	0.66	
				Significant difference at p = 0.05	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes

#### 4.4.1.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error between the learners and the general population for Questions 2, 3, 4, 5, 8, 9 and 10, which deal with:

- awareness of the hazards of coal fires in the community
- awareness of mining company fire-fighting efforts in the community
- awareness of mining company fire-fighting equipment in the community
- acknowledgement that a mining company has informed the community about fire-fighting efforts

- interest to know about the hazards of coal fires
- interest to know how a mining company combats coal fires, and
- acknowledgement that mine workers in their community are aware of the hazards of coal fires.

#### 4.4.1.4 Comments

There is a potential hazard in the community. This is an observation drawn from the general population input that there is potential for a severe unpredictable disaster. The fact that parents are not sufficiently aware of coal hazards and the lack of information from the mining companies implies parents are not in a good position to advise, educate or warn their children about potential coal hazards. Senior learners are seemingly not better aware than their parents. They constitute a minority of the total population. Amongst their rank, it is clear that they are not better informed and could not predict any unforeseen event of this nature. Therefore, fear of a potential disaster is evident from the learners and general population. More evidence is drawn from examining other data sources in Chapters 5 and 6.



#### 4.4.2 *Air-Quality Monitoring*

##### 4.4.2.1 Learners

The analysed data (Table 18) show that 51 % of the learners are aware of the value of good-quality air. Of this 51 %:

- 55 % are aware of the hazards of bad air
- 77 % are aware of mining company air-quality monitoring
- 25 % have received information from a mining company about the value of air-quality monitoring
- 22 % agree that the municipality has informed the community about the value of air-quality monitoring
- 83 % are interested in knowing about mining company air-quality monitoring, and

- 57 % agree that mine workers in their community are aware of the hazards of coal-mining and coal-processing on air-quality.

#### 4.4.2.2 General Population

The analysed data (Table 18) show that 56 % of the general population are aware of the value of good-quality air. Of this 56 %:

- 59 % are aware of the hazards of bad air
- 64 % are aware of mining company air-quality monitoring
- 21 % have received information from a mining company about the value of air-quality monitoring
- 29 % agree that the municipality has informed the community about the value of air-quality monitoring
- 64 % are interested in knowing about mining company air-quality monitoring, and
- 66 % agree that mine workers in their community are aware of the hazards of coal-mining and coal-processing on air-quality.

**Table 18: Questionnaire responses on air-quality monitoring**

Academic ==> LEARNERS											
			Criteria	Q1 =3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	
Count Yes	156	168	3	156	168	120	77	68	250	172	
Count Sometimes	44	62	<3	147	135	36	226	235	53	131	
Count No	95	62	Checksum	303							
Count Others	8	22	3	51%	55%	77%	25%	22%	83%	57%	
Check Sum	303	303	<3	49%	45%	23%	75%	78%	17%	43%	
Fraction of entire population											
GENERAL POPULATION											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	
Count Yes	97	101	3	97	101	62	36	50	110	113	
Count Sometimes	21	18	<3	75	71	39	136	122	62	59	
Count No	51	48	Checksum	172							
Count Others	3	5	3	56%	59%	64%	21%	29%	64%	66%	
Check Sum	172	172	<3	44%	41%	40%	79%	71%	36%	34%	
Fraction of entire population											
				100%	100%	100%	100%	100%	100%	100%	
RATIO Academic: General				0.91	1.03	1.2	1.21	0.77	1.29	0.86	
Significant difference at p = 0.05				No	No	Yes	Yes	No	Yes	No	

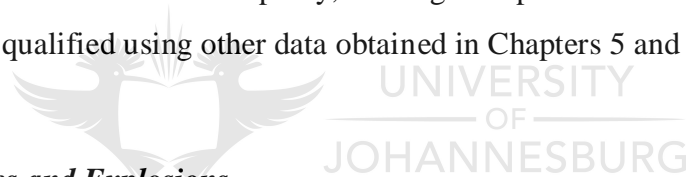
#### 4.4.2.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error between the learners and general population for Questions 3, 4, and 6, which deal with:

- awareness of mining company air-quality monitoring
- acknowledgement that a mining company has informed the community on the value of air-quality monitoring, and
- interest to know about mining company air-quality monitoring.

#### 4.4.2.4 Comments

Though the learners and general population are aware of the value of good air and the hazard of bad air, there is potential for a disaster as a result of the poor level of awareness. There is little information on air-quality within the community, and the fraction of those aware in comparison with the total population is low. There is evidence of poor communication between the municipality, mining companies and the community. This statement can be qualified using other data obtained in Chapters 5 and 6.



#### 4.4.3 *Explosives and Explosions*

##### 4.4.3.1 Learners

The analysed data (Table 19) show that 57 % of learners are aware of mine explosives. Of this 57 %:

- 75 % are aware of the use of explosives during coal-mining
- 22 % have received information about mining company use of explosives in mines
- 25 % agree that the municipality has informed the community about company use of explosives in mines
- 74 % are aware of the hazards associated with the explosives
- 74 % are interested in knowing about the hazards of explosives
- 84 % are interested in knowing how a mining company protects the community from the hazards arising from the use of mine explosives, and

- 49 % agree that mine workers in their community are aware of the hazards of mine explosives.

#### 4.4.3.2 General Population

The analysed data (Table 19) show that 60 % of the general population are aware of mine explosives. Of this 60 %:

- 85 % are aware of the use of explosives during coal-mining
- 23 % have received information about mining company use of explosives in mines
- 25 % agree that the municipality has informed the community about company use of explosives in mines
- 69 % are aware of the hazards associated with the explosives
- 67 % are interested in knowing about the hazards of explosives
- 71 % are interested in knowing how a mining company protects the community from the hazards arising from the use of mine explosives, and
- 56 % agree that mine workers in their community are aware of the hazards of mine explosives.

**Table 19: Questionnaire responses on explosives and explosions**

Academic ==> LEARNERS											
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Count Yes	129	97	3	129	97	49	56	95	168	190	111
Count Sometimes	29	42	<3	98	32	178	171	34	59	37	116
Count No	60	76	Checksum	227							
Count Others	9	12	3	57%	75%	22%	25%	74%	74%	84%	49%
Check Sum	227	227	<3	43%	25%	78%	75%	26%	26%	16%	51%
Fraction of entire population											
GENERAL POPULATION											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Count Yes	130	111	3	130	111	50	55	90	145	154	123
Count Sometimes	29	19	<3	88	19	168	163	40	73	64	95
Count No	54	58	Checksum	218							
Count Others	5	30	3	60%	85%	23%	25%	69%	67%	71%	56%
Check Sum	218	218	<3	40%	15%	77%	75%	31%	33%	29%	44%
Fraction of entire population											
				100%	100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				0.95	0.88	0.94	0.98	1.06	1.11	1.18	0.87
Significant difference at p = 0.05				No	Yes	No	No	No	Yes	Yes	Yes

#### **4.4.3.3 Comparing responses from the Learners and the General Population**

There are significant differences at  $p = 0.05$  level for the standard error between the learners and the general population, for Questions 2, 6, 7, and 8 which deal with:

- awareness of the use of explosives during coal-mining
- interest in knowing about the hazards of explosives
- interest in knowing how a mining company protects the community from the hazards arising from the use of mine explosives, and
- acknowledgement that mine workers from the community are aware of the hazards of mine explosives.

#### **4.4.3.4 Comments**

From the response data, the following preliminary observations were made that, the learners and the general population are less aware of explosives than explosions. As many of the learners and the general population are aware of the hazards associated with the use of explosives, and the interest to know more about these hazards, there is evidence of insufficient information provided to the community by either mining companies or the municipality. This indicates a weakness at the level of communication between the mining companies and the community which directly impact on community health. Once the senior learners and parents are ill informed, there is every indication that even less information is available to the younger learners and children. This is an indication of an unprepared state for a disaster in the community. Further evidence is drawn from other data sources in Chapters 5 and 6.

#### **4.4.4 *Underground Surveillance***

##### **4.4.4.1 Learners**

The analysed data (Table 20) show that 46 % of the learners are aware of company surveillance on mines. Of this 46 %:

- 51 % are aware of company underground surveillance in mines
- 23 % have received information from a mining company about underground surveillance on mines

- 24 % agree that the municipality has informed the community about mining company underground surveillance
- 74 % are interested in knowing about mining company underground surveillance
- 54 % agree that mine workers from their community are aware of mining company underground surveillance, and
- 55 % agree that mine workers from their community are aware of the need for company underground surveillance.

#### **4.4.4.2 General Population**

The analysed data (Table 20) show that 48 % of the general population are aware of company surveillance on mines. Of this 48 %:

- 51 % are aware of company underground surveillance in mines
- 32 % have received information from a mining company about underground surveillance on mines
- 32 % agree that the municipality has informed the community about mining company underground surveillance
- 66 % are interested in knowing about mining company underground surveillance
- 62 % agree that mine workers from their community are aware of mining company underground surveillance, and
- 52 % agree that mine workers from their community are aware of the need for company underground surveillance.



**Table 20: Questionnaire responses on underground surveillance**

Academic ==> LEARNERS											
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	
Count Yes	125	140	3	125	140	63	66	203	148	151	
Count Sometimes	42	46	<3	149	134	211	208	71	126	123	
Count No	100	76	Checksum	274							
Count Others	7	12	3	46%	51%	23%	24%	74%	54%	55%	
Check Sum	274	274	<3	54%	49%	77%	76%	26%	46%	45%	
Fraction of entire population				54%							
GENERAL POPULATION											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	
Count Yes	95	100	3	95	100	62	62	130	122	101	
Count Sometimes	37	37	<3	101	96	134	134	66	74	95	
Count No	58	55	Checksum	196							
Count Others	6	4	3	48%	51%	32%	32%	66%	62%	52%	
Check Sum	196	196	<3	52%	49%	68%	68%	34%	38%	48%	
Fraction of entire population				52%							
				100%	100%	100%	100%	100%	100%	100%	
RATIO Academic: General				0.94	1.06	0.73	0.76	1.12	0.87	1.07	
Significant difference at p = 0.05				Yes	No	Yes	Yes	No	Yes	No	

**4.4.4.3 Comparing responses from the Learners and the General Population**

There are significant differences at  $p = 0.05$  level for the standard error between the learners and the general population, for Questions 1, 3, 4 and 6, which deal with:

- awareness of company surveillance on mines
- acknowledgement that a mining company has informed the community about underground surveillance
- acknowledgement that the municipality has informed the community about mining company underground surveillance, and
- acknowledgement that mine workers from the community are aware of mining company underground surveillance.

**4.4.4.4 Comments**

There is a disparity between the learners and the general population understanding about what underground surveillance is and its purpose. The difference in the scores between the learners and the general population is substantial, indicating that there is a potential for misery awaiting the community. For example, parents are not better aware and informed than their children. Therefore, parents are not in a good position to educate, inform and advise their children of any impending danger in the event of a system failure. The situation is even worse among the learners, where senior learners are less aware and

informed than the general population. Senior learners constitute a fraction of the youth population and school-going population. If they are poorly informed, then there is a potential disaster in the community in the event of a system failure, as they cannot imagine the consequences to the community as a whole. More information is drawn from other data sources in Chapters 5 and 6.

## 4.5 Strategic Environmental Management Decisions/Planning

Strategic environmental management involves a series of decisions that are carefully planned and executed. Strategic environmental management decisions are growing concerns in business planning and the environment nowadays. Strategic environmental management deals with specific decisions/planning aimed at managing hazards in mining areas as discussed in this section. These decisions are applicable using all available techniques with existing technologies. Five strategic managerial decisions were identified, namely: environmental hazards and planning decisions; environmental research on hazards; equipment for hazard management; monitoring and control systems for hazards, and improve risk and awareness practices.

### 4.5.1 *Environmental Hazards and Planning Decisions*

#### 4.5.1.1 Learners

The analysed data (Table 21) show that 73 % of the learners are aware of mining hazards that surround their community. Of this 73 %:

- 38 % are aware of company environmental decisions/planning in hazard management
- 19 % agree that their community has specific decisions against mining hazards
- 26 % agree that there is a communication link between their community and a mining company
- 14 % agree that a mining company has informed their community about environmental hazard decisions and planning
- 24 % agree that their community has participated with a mining company on environmental hazard decisions



- 24 % are aware of an environmental project initiated by a mining company in their community
- 28 % are aware of a socio-economic investment made by a mining company in their community, and
- 15 % are happy with their surroundings.

#### **4.5.1.2 General Population**

The analysed data (Table 21) show that 64 % of the general population are aware of mining hazards that surround their community. Of this 64 %:

- 35 % are aware of company environmental decisions/planning in hazard management
- 12 % agree that their community has specific decisions against mining hazards
- 13 % agree that there is a communication link between their community and a mining company
- 7 % agree that a mining company has informed their community about environmental hazard decisions and planning
- 12 % agree that their community has participated with a mining company on environmental hazard decisions
- 13 % are aware of an environmental project initiated by a mining company in their community
- 23 % are aware of a socio-economic investment made by a mining company in their community, and
- 13 % are happy with their surroundings.



#### 4.5.1.4 Comments

A planning decision is as important as its execution results. Planning decisions seldom involve children. Although learners can read and write – in some cases better than their parents – they often lack personal experience. Whereas parents are able to give personal accounts of incidents, learners seldom can. From the analysed data, parents are less aware, less informed, had little participation in mining company environmental decisions and were mostly unhappy with their surroundings. This is an indication of a potential disaster in the community. Once parents are less aware and informed, they cannot educate, inform and advise their children of potential mining hazards. In contrast, senior learners who took part in this research constitute only a fraction of the learners and the general population without many personal experiences. They are not all aware, not well informed and not happy with their surroundings. This indicates that neither parents nor senior learners are in a good position to provide advice to junior learners and the community. More evidence is drawn from the responses to the open-ended questions and other data sources in Chapters 5 and 6.

#### 4.5.1.5 Knowledge-based responses

Open-ended questions were administered as Questions 4a, 4b, 5a, 5b, 11a, 11b, 13a, 13b, 13c and 13d (Table 41 of Annexure 5). A range of inputs was made. The data shows existence of the following problems: unemployment, lack of education, air pollution and land pollution. Respondents also suggested the relocation of mines, and the need for preventive measures amongst others. Further evidence indicates that respondents can only identify some hazards and undesirables in their community, but were unable to identify and name good initiatives in the community that have been provided by mining companies.

### 4.5.2 *Environmental Research on Hazards*

#### 4.5.2.1 Learners

The analysed data (Table 22) show that 46 % of the learners are aware of environmental research and development in their community. Of this 46 %:

- 85 % are aware of environmental research on identification of hazards

- 29 % agree that a mining company has undertaken environmental research on hazard management in their community
- 27 % are aware of projects on hazards undertaken by a mining company in the community
- 21 % are satisfied with environmental research on hazard management in the community, and
- 74 % are interested in knowing about environmental research on hazard management in their community.

#### 4.5.2.2 General Population

The analysed data (Table 22) show that 33 % of the general population are aware of environmental research and development in the community. Of this 33 %:

- 87 % are aware of environmental research on identification of hazards
- 17 % agree that a mining company has undertaken environmental research on hazard management in their community
- 14 % are aware of projects on hazards undertaken by a mining company in the community
- 15 % are satisfied with environmental research on hazard management in the community, and
- 79 % are interested in knowing about environmental research on hazard management in their community.

**Table 22: Questionnaire responses on environmental research on hazards**

Academic ==> LEARNERS												
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5a=3	Q5b=3	Q6=3	Q7=3	Q8=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3												
Count Yes	61	52	3	61	52	38	36	0	0	0	28	98
Count Sometimes	31	33	<3	72	9	95	97	133	133	133	105	35
Count No	40	46	Checksum	133								
Count Others	1	2	3	46%	85%	29%	27%	0%	0%	0%	21%	74%
Check Sum	133	133	<3	54%	15%	71%	73%	100%	100%	100%	79%	26%
Fraction of entire population				7%								
GENERAL POPULATION												
				Q1	Q2	Q3	Q4	Q5a	Q5b	Q6	Q7	Q8=3
Count Yes	46	40	3	46	40	23	20	1	0	0	21	109
Count Sometimes	13	13	<3	92	6	115	118	137	138	138	117	29
Count No	79	80	Checksum	138								
Count Others	0	5	3	33%	87%	17%	14%	1%	0%	0%	15%	79%
Check Sum	138	138	<3	67%	13%	83%	86%	99%	100%	100%	85%	21%
Fraction of entire population				4%								
				100%	100%	100%	100%	100%	100%	100%	100%	
<b>RATIO Academic: General</b>				1.38	0.98	1.71	1.87	0	0	0	1.38	0.93
Significant difference at p = 0.05				Yes	Yes	Yes	Yes	No	No	No	Yes	No

#### **4.5.2.3 Comparing responses from the Learners and the General Population**

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 1, 2, 3, 4 and 7, which deal with:

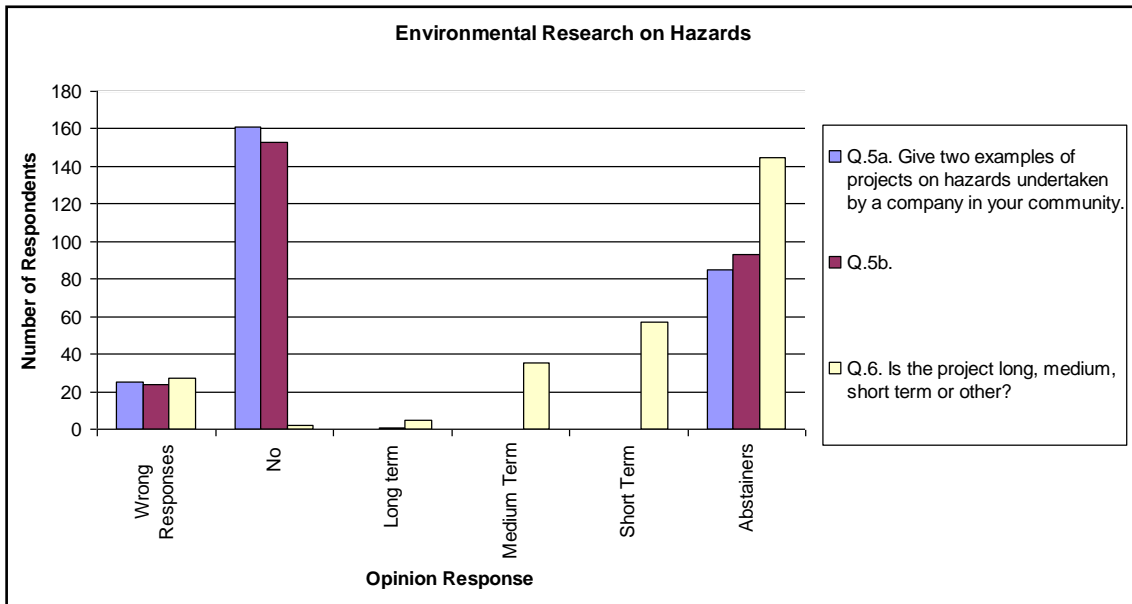
- awareness of environmental research and development in their community
- awareness of environmental research on identification of hazards
- acknowledgement that a mining company has undertaken any environmental research on hazard management in their community
- awareness of a project on hazards undertaken by a mining company in their community interest, and
- satisfaction with environmental research on hazard management in their community.

#### **4.5.2.4 Comments**

Analysed data show that senior learners are more aware and informed than the general population. However, their knowledge does not suffice independent of parental care. This implies children are at risk of potential disaster and is evidence that parents have insufficient knowledge and experience to inform, educate and advise their children on companies and other decisions in their community. More evidence is drawn from the open-ended questions and other data sources in Chapters 5 and 6.

#### **4.5.2.5 Knowledge-based responses**

Two open-ended questions were included in the questionnaire – Questions 5a, 5b and Question 6. Question 5 requested respondents to give two examples of projects on hazards initiated by a mining company in the community and Question 6 requested respondents to state whether the project is long-, medium-, short-term or other. Inputs show that the community dwellers are either not aware of an initiated project or a project does not exist. There are substantial “No”, “abstained”, “incorrectly attempted” responses and insignificant “long-term, medium-term and short-term” responses (Figure 9). The response from Question 5 related to the response to Question 6. Once an initiated project cannot be identified, then the duration of the project is meaningless.



**Figure 9: Responses to open-ended (knowledge-based) question on environmental research on hazards**

### 4.5.3 *Equipment for Hazard Management*

#### 4.5.3.1 Learners



The analysed data (Table 23) show that 45 % of the learners are aware of a mining company purchasing new equipment. Of this 45 %:

- 72 % are aware of the type and purpose of the equipment purchased by the mining company
- 23 % are aware of equipment being purchased for hazard management in the community
- 25 % have been informed on existing hazard equipment by mining companies
- 18 % agree that the municipality has informed the community about existing and new equipment for hazard management
- 28 % have received education on the use and value of hazard equipment, and
- 81 % are interested in obtaining information from a mining company on hazard management.



### 4.5.3.2 General Population

The analysed data (Table 23) show that 27 % of the general population are aware of a mining company purchasing new equipment. Of this 27 %:

- 91 % are aware of the type and purpose of the equipment purchased by the mining company
- 15 % are aware of equipment being purchased for hazard management in the community
- 11 % have been informed on existing hazard equipment by mining companies
- 10 % agree that the municipality has informed the community about existing and new equipment for hazard management
- 17 % have received education on the use and value of hazard equipment, and
- 73 % are interested in obtaining information from a mining company on hazard management.

**Table 23: Questionnaire responses on equipment for hazard management**

Academic ==> LEARNERS				Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6a=3	Q6b=3	Q7=3	Q8=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3													
Count Yes	58	42	3	58	42	30	32	24	0	0	37	105	
Count Sometimes	14	20	<3	72	16	100	98	106	130	130	93	25	
Count No	56	67	Checksum	130									
Count Others	2	1	3	45%	72%	23%	25%	18%	0%	0%	28%	81%	
Check Sum	130	130	<3	55%	28%	77%	75%	82%	100%	100%	72%	19%	
Fraction of entire population					12%								
GENERAL POPULATION				Q1	Q2	Q3	Q4	Q5	Q6a	Q6b	Q7	Q8=3	
Count Yes	35	32	3	35	32	20	14	13	0	0	22	95	
Count Sometimes	8	9	<3	96	3	111	117	118	131	131	109	36	
Count No	88	90	Checksum	131									
Count Others	0	0	3	27%	91%	15%	11%	10%	0%	0%	17%	73%	
Check Sum	131	131	<3	73%	9%	85%	89%	90%	100%	100%	83%	27%	
Fraction of entire population					4%								
					100%	100%	100%	100%	100%	100%	100%		
RATIO Academic: General					1.67	0.79	1.51	2.3	1.86	0	0	1.69	1.11
Significant difference at p = 0.05					Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes

### 4.5.3.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 1, 2, 3, 4, 5, 7 and 8, which deal with:

- awareness of a mining company purchasing new equipment in their community

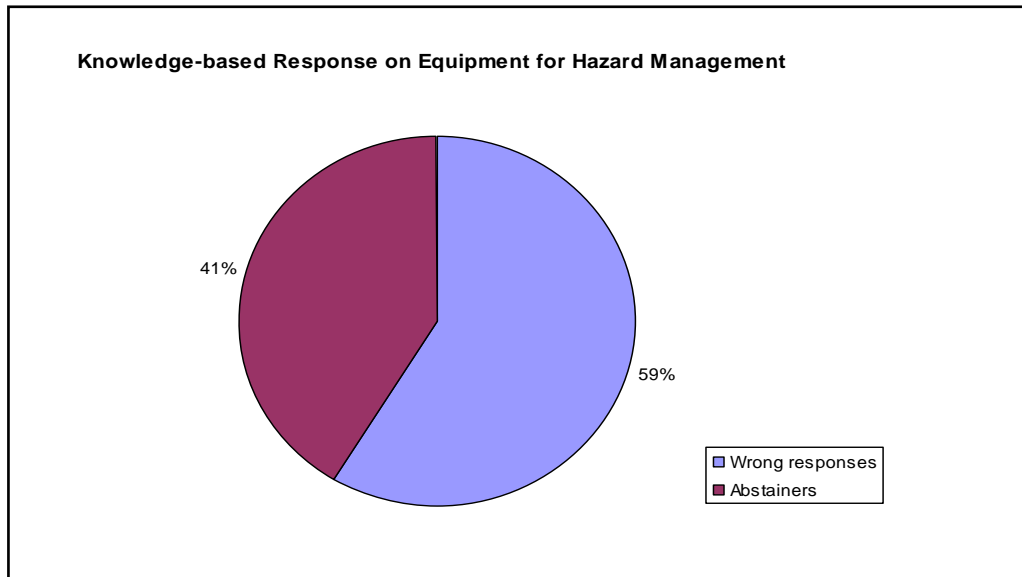
- awareness of the type and purpose of the equipment bought by the mining company
- awareness of equipment being purchased for hazard management in the community
- acknowledgement of being informed on existing hazard equipment by mining companies
- acknowledgement that the municipality has informed the community about existing and new equipment for hazard management
- acknowledgement of being educated by a mining company on the use and value of hazard equipment, and
- the interest in obtaining information from a mining company on hazard management.

#### **4.5.3.4 Comments**

The data analysed show that learners are more aware and informed than the general population. However, the learners' knowledge is insufficient to not need parental care and guidance. Furthermore, senior learners who participated in this research constitute only a fraction of the general population. The general population is less informed and less aware, which implies that their children are at risk of a potential disaster. Once parents cannot inform, educate and advise their children, it indicates a community exposed to danger. More evidence is obtained from the open-ended questions and other data in Chapters 5 and 6.

#### **4.5.3.5 Knowledge-based responses**

Only one open-ended question was included on the form. Respondents were requested to identify and name two examples of new equipment bought by a mining company for hazard management (Question 6 (a) and (b)). A total of 522 responses were obtained, classified into two categories. There were 273 wrong responses and 249 abstentions (Figure 10 (Annexure 5)). No respondent acknowledged awareness of the type, purpose, and value of equipment bought or could identify a machine by name. It demonstrates that respondents do not know what equipment is bought for industrial use and neither do they know what equipment is bought or used for hazard management. It further clarifies doubts about the level of awareness and guessed responses in the multiple-choice questions.



**Figure 10: Responses to open-ended (knowledge-based) question on equipment for hazard management**

#### 4.5.4 *Monitoring and Control Systems for Hazards*

##### 4.5.4.1 Learners

The analysed data (Table 24) show that 46 % of the learners are aware of monitoring and control activities in their community. Of this 46 %:

- 30 % have been informed by a mining company about monitoring and control activities for hazards
- 39 % have been involved in mining company monitoring and control activities for hazards
- 29 % agree that the municipality has taken part in community monitoring and control activities for hazards
- 34 % agree that the municipality has informed the public about the need for a mining company to monitor and control hazardous activities in communities
- 50 % agree that the community has been informed that mining is a hazard to the community in some form or way, and
- 81 % are interested in knowing about mining company monitoring and control of hazardous activities.

#### 4.5.4.2 General Population

The analysed data (Table 24) show that 26 % of the general population are aware of monitoring and control activities in their community. Of the 26 %:

- 7 % have been informed by a mining company about monitoring and control activities for hazards
- 14 % have been involved in mining company monitoring and control activities for hazards
- 14 % agree that the municipality has taken part in community monitoring and control activities for hazards
- 15 % agree that the municipality has informed the public about the need for a mining company to monitor and control hazardous activities in communities
- 18 % agree that the community has been informed that mining is a hazard to the community in some form or way, and
- 70 % are interested in knowing about mining company monitoring and control of hazardous activities.

**Table 24: Questionnaire responses on monitoring and control system for hazards**

Academic ==> LEARNERS				Criteria	Q1=3	Q2=3	Q3a=3	Q3b=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3														
					Q1	Q2	Q3a	Q3b	Q4	Q5	Q6	Q7	Q8	
Count Yes	56	36	3	56	36	122	122	47	35	41	61	99		
Count Sometimes	23	24	<3	66	86	0	0	75	87	81	61	23		
Count No	41	60	Checksum	122										
Count Others	2	2	3	46%	30%	100%	100%	39%	29%	34%	50%	81%		
Check Sum	122	122	<3	54%	70%	0%	0%	61%	71%	66%	50%	19%		
				Fraction of entire population		70%								
GENERAL POPULATION					Q1	Q2	Q3a	Q3b	Q4	Q5	Q6	Q7	Q8	
Count Yes	30	8	3	30	8	116	116	16	16	17	21	81		
Count Sometimes	11	13	<3	86	108	0	0	100	100	99	95	35		
Count No	73	85	Checksum	116										
Count Others	2	10	3	26%	7%	100%	100%	14%	14%	15%	18%	70%		
Check Sum	116	116	<3	74%	93%	0%	0%	86%	86%	85%	82%	30		
				Fraction of entire population		93%								
				100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
RATIO Academic: General					1.77	4.28			2.79	2.08	2.29	2.76	1.16	
				Significant difference at p = 0.05		Yes	Yes			Yes	Yes	Yes	Yes	Yes

#### 4.5.4.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 1, 2, 4, 5, 6, 7 and 8, which deal with:

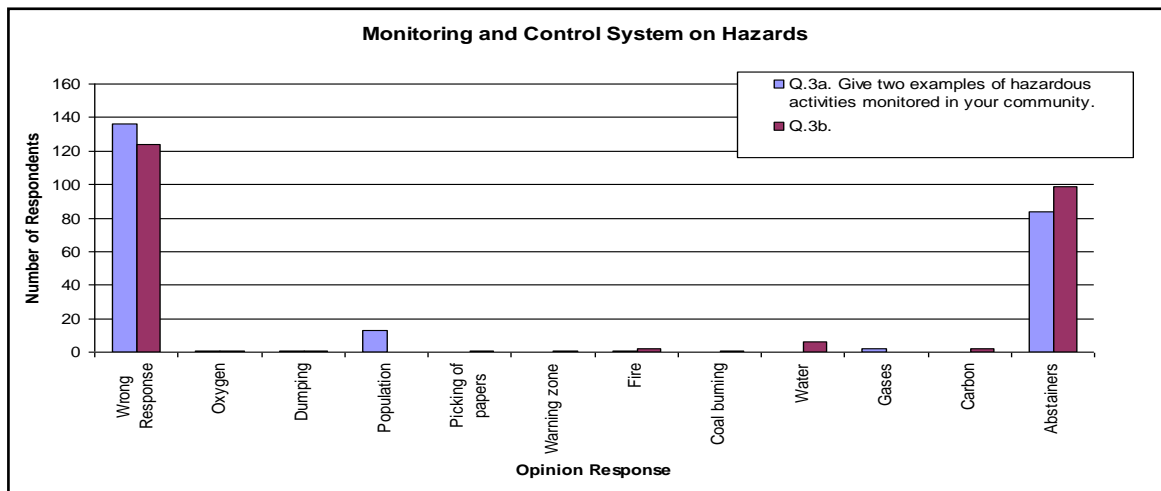
- awareness of monitoring and control activities in their community
- acknowledgement that a mining company has informed the community about monitoring and control activities for hazards
- acknowledgement that the community has been involved in some mining company monitoring and control activities for hazards
- acknowledgement that the municipality has taken part in community monitoring and control activities for hazards
- acknowledgement that the municipality has informed the public about the need for a company to monitor and control hazardous activities in communities
- acknowledgement that the community has been informed that mining is a hazard to the community in some form or way, and
- the interest in knowing about mining company monitoring and control of hazardous activities.

#### **4.5.4.4 Comments**

Analysed data show that the general population is less aware than the learners. This is an indication of a potential disaster. Once parents are not aware of the hazardous activities of mining and not aware of the monitoring and control processes for hazards, they are unable to educate and advise their children about the hazards. In contrast, senior learners constitute only a fraction of the learners' population and of the general population. This implies they are also in great danger as the majority of the learners are not aware of their immediate surroundings and existing hazards. More evidence is drawn from the responses to an open-ended question and other data sources in Chapters 5 and 6.

#### **4.5.4.5 Knowledge-based responses**

One open-ended question was included (Question 3 (a) and (b)). The question requested respondents to give two examples of hazardous activities ever monitored in their community. Data obtained show a large number of wrong attempts and abstentions (Figure 11). This implies little or no monitoring has taken place in the community over the years. This response contradicted the multiple-choice questions, as neither the learners nor the general population was able to provide even one correct example of a hazardous activity monitored.



**Figure 11: Responses to open-ended (knowledge-based) question on monitoring and control system on hazards**

#### 4.5.5 *Improve Risk and Awareness Practices*

##### 4.5.5.1 Learners

The analysed data (Table 25) show that 74 % of the learners are aware of the risk in mining as hazards. Of this 74 %:

- 81 % are aware of possible mine hazard-related effects
- 30 % are informed of company efforts to improve risk and hazard-prone practices
- 33 % agree that there is a communication link between their community and a mining company on risks and hazards from mining
- 42 % agree that there is a communication link between their community and the State on risks and hazards from mining
- 25 % acknowledge projects undertaken by a mining company on community risk and hazard prevention
- 34 % acknowledge a co-project undertaken by community, State and mining companies on risk and hazard management, and
- 80 % are interested in knowing more about mine risk and hazard management in their community.

#### 4.5.5.2 General Population

The analysed data (Table 25) show that 61 % of the general population are aware of the risk in mining as hazards. Of this 61 %:

- 86 % are aware of possible mine hazard-related effects
- 14 % are informed of company efforts to improve risk and hazard-prone practices
- 17 % agree that there is a communication link between their community and a mining company on risks and hazards from mining
- 18 % agree that there is a communication link between their community and the State on risks and hazards from mining
- 9 % acknowledge projects undertaken by a mining company on community risk and hazard prevention
- 12 % acknowledge a co-project undertaken by community, State and mining companies on risk and hazard management, and
- 76 % are interested in knowing more about mine risk and hazard management in their community.

**Table 25: Questionnaire responses on improve risk and awareness practices**

Academic ==> LEARNERS			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3											
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Count Yes	78	63	3	78	63	31	35	44	26	36	84
Count Sometimes	9	14	<3	27	15	74	70	61	79	69	21
Count No	17	25	Checksum	105							
Count Others	1	3	3	74%	81%	30%	33%	42%	25%	34%	80%
Check Sum	105	105	<3	26%	19%	70%	67%	58%	75%	66%	20%
Fraction of entire population				14%							
GENERAL POPULATION			Criteria	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8=3
Count Yes	79	68	3	79	68	18	22	23	11	16	98
Count Sometimes	13	19	<3	50	11	111	107	106	113	113	31
Count No	36	40	Checksum	129							
Count Others	1	2	3	61%	86%	14%	17%	18%	9%	12%	76%
Check Sum	129	129	<3	39%	14%	86%	83%	82%	91%	88%	24%
Fraction of entire population				9%							
				100%	100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				1.21	0.94	2.12	1.95	2.35	2.9	2.76	1.05
Significant difference at p = 0.05				Yes	No	Yes	Yes	Yes	Yes	Yes	No

#### 4.5.5.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population for Questions 1, 3, 4, 5, 6 and 7, which deal with:

- awareness of the risk in mining as hazards
- acknowledgement that the community has been informed of company efforts to improve risk and hazard-prone practices
- acknowledgement that there is a communication link between the community and a mining company on risks and hazards from mining
- acknowledgement that there is a communication link between the community and the State on risks and hazards from mining
- acknowledgement that a project has been undertaken by a mining company on community risk and hazard prevention, and
- acknowledgement that a co-project has been undertaken by community, State and mining companies on risk and hazard management.

#### 4.5.5.4 Comments



The analysed data (Table 25) show that the general population is hardly aware of the risk of mining and its associated hazards. This is aggravated by poor communication between the community, the State, the municipality and the mining companies which combine to increase the potential for a disaster within the community. Though the learners are slightly better informed than the general population, their level of information is insufficient to create awareness in a large community. Therefore, they are also not in a good position to educate and advise the community at large. More evidence is examined from other data collected in Chapters 5 and 6.

## 4.6 Environmental Legal Application and Compliance

Environmental legal application and compliance are rules and regulations (laws) made by people to govern society (social-sphere). Laws are also a measuring tool of human civilisation. Environmental legal application and compliance are sets of rules and regulations that govern and regulate human co-existence with nature and the use of natural resources. The legal arm of the environment is a powerful tool to regulate the environment



and business activities, but its application has to be measured along many considerations such as people, development and resource conservation. In South Africa, legislation has been enacted to protect the environment and to ensure sustainable communities (for example, the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998); the Environment Conservation Act, Act No. 73 of 1989 (RSA 1989); the Minerals Act, Act No. 50 of 1991 (RSA 1991), and the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002)).

Questionnaires were used to assess community awareness about environmental legal application and compliance in the townships. Five sub-sections constitute this section on environmental legal application and compliance (Table 5).

#### 4.6.1 *Environmental Legislation on Hazards*

##### 4.6.1.1 Learners

The analysed data (Table 26) show that 63 % of the learners are aware of environmental legislation in their community. Of this 63 %:

- 96 % are aware of environmental legislation related to mine hazards in their community
- 30 % agree that the community has contributed to environmental legislation relating to hazards
- 39 % agree that the community has been educated on environmental legislation relating to hazards
- 33 % agree that there is a link between the mining companies and community in terms of participation in environmental legislation
- 31 % agree that there is a link between the community and the State in terms of participation in environmental legal aspects
- 28 % acknowledge a tripartite communication link between community, mining companies and municipality on environmental legislation, and
- 84 % are interested in knowing about environmental hazards and environmental legislation in the community.

#### 4.6.1.2 General Population

The analysed data (Table 26) show that 41 % of the general population are aware of environmental legislation. Of this 41 %:

- 48 % are aware of environmental legislation related to mine hazards in their community
- 16 % agree that the community has contributed to environmental legislation relating to hazards
- 23 % agree that the community has been educated on environmental legislation relating to hazards
- 23 % agree that there is a link between the mining companies and community in terms of participation in environmental legislation
- 20 % agree that there is a link between the community and the State in terms of participation in environmental legal aspects
- 17 % acknowledge a tripartite communication link between community, mining companies and municipality on environmental legislation, and
- 91 % are interested in knowing about environmental hazards and environmental legislation in the community.

**Table 26: Questionnaire responses on environmental legislation on hazards**

Academic ==> LEARNERS				Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8a=3	Q8b=3	Q9=3	
				Take score 3 & above to indicate awareness & proceed further. Discard if less than 3										
			<b>Criteria</b>	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8a	Q8b	Q9	
Count Yes	67	64	3	67	64	32	41	35	33	30	1	1	89	
Count Sometimes	16	19	<3	39	3	74	65	71	73	76	105	105	17	
Count No	23	21	<b>Checksum</b>	106										
Count Others	0	2	3	63%	96%	30%	39%	33%	31%	28%	1%	1%	84%	
Check Sum	106	106	<3	37%	4%	70%	61%	67%	69%	72%	99%	99%	16%	
				<b>Fraction of entire population</b>		3%								
GENERAL POPULATION				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8a	Q8b	Q9	
Count Yes	38	45	3	38	45	15	21	21	19	16	6	6	85	
Count Sometimes	18	9	<3	55	48	78	72	72	74	77	87	87	8	
Count No	37	39	<b>Checksum</b>	93										
Count Others	0	0	3	41%	48%	16%	23%	23%	20%	17%	6%	6%	91%	
Check Sum	93	93	<3	59%	52%	84%	77%	77%	80%	83%	94%	94	9	
				<b>Fraction of entire population</b>		52%								
				100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
<b>RATIO Academic: General</b>				1.55	0.81	1.87	1.71	1.46	1.52	1.65	0.15	0.15	0.92	
				<b>Significant difference at p = 0.05</b>		Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes

#### 4.6.1.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 1, 2, 3, 4, 5, 6, 7 and 9, which deal with:

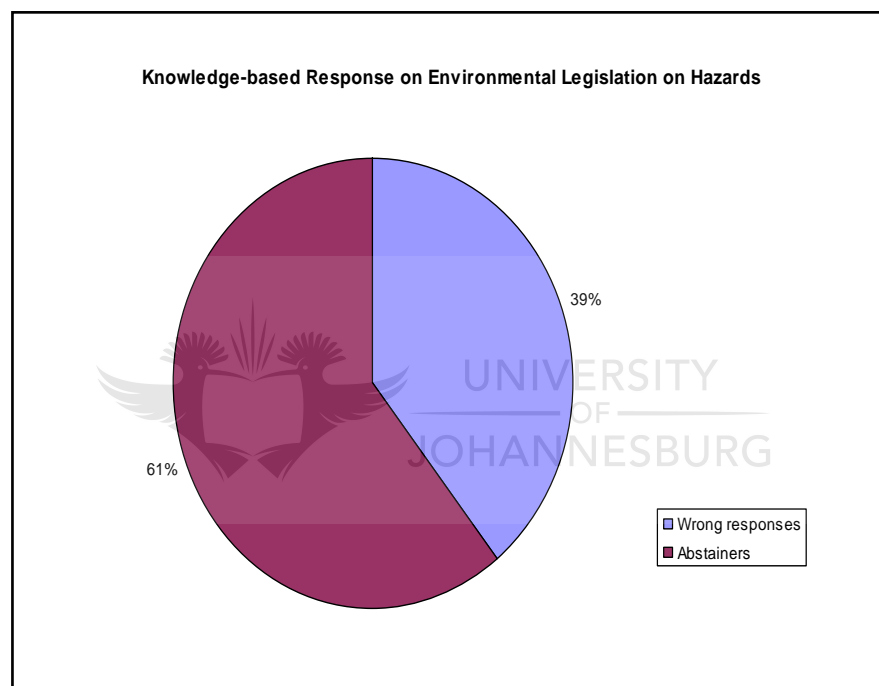
- awareness of environmental legislation in the community
- awareness of environmental legislation related to mine hazards in the community
- acknowledgement that the community has contributed to environmental legislation regarding hazards
- acknowledgement that the community has been educated on environmental legislation relating to hazards
- acknowledgement that there is a link between the mining companies and community in terms of participation in environmental legislation
- acknowledgement that there is a link between community and the State in terms of participation in environmental legal aspects
- acknowledgement that there is a tripartite communication link between community, mining companies and municipality on environmental legislation, and
- the interest in knowing about environmental hazards and environmental legislation in the community.

#### 4.6.1.4 Comments

Analysed data show that though the learners are generally better aware than the general population, more parents are aware of environmental legislation on mining hazards in their community. The overview responses show a potential for disaster. Parents are ill-informed, less aware and less educated. Therefore, there is a problem as parents cannot educate, advise and protect their children from mining hazards as there is a knowledge gap which cannot be closed easily. To further verify the level of awareness and environmental rights, inputs are drawn from an open-ended question (Question 8) and other sources of data during the course of this study in Chapters 5 and 6.

#### 4.6.1.5 Knowledge-based responses

Question 8a and 8b was the only open-ended question included in the multiple-choice questionnaire for this sub-section. Data show that the community is not aware of any environmental legislation. A total of 398 responses were obtained, of which 246 were abstained and 152 were wrongly attempted answers (Figure 12 and Table 46). There was no correct response. This indicates a total lack of awareness about environmental legal rights in the community. Therefore, the community's awareness is based on intuitive knowledge and personal experiences rather than a practical example.



**Figure 12: Responses to open-ended (knowledge-based) question on environmental legislation on hazards**

#### 4.6.2 *National Environmental Management Act, Act No. 107 of 1998*

##### 4.6.2.1 Learners

The analysed data (Table 27) show that 34 % of the learners are aware of the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998). Of this 34 %:

- 82 % are aware of the National Environmental Management Act compliance in the community



- 23 % agree that a mining company has informed the community about the National Environmental Management Act requirements/ compliance
- 23 % agree that the municipality has informed the community about the National Environmental Management Act requirements/ compliance
- 18 % agree that there is a collective effort between the municipality, a mining company and the community on National Environmental Management Act compliance
- 58 % agree that there is a need for a collective effort on National Environmental Management Act compliance, and
- 89 % are interested in knowing about mining company application of the National Environmental Management Act.

#### **4.6.2.2 General Population**

The analysed data (Table 27) show that 20 % of the general population are aware of the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998). Of this 20 %:

- 85 % are aware of National Environmental Management Act compliance in the community
- 15 % agree that a mining company has informed the community about the National Environmental Management Act requirements/ compliance
- 18 % agree that the municipality has informed the community about the National Environmental Management Act requirements/ compliance
- 15 % agree that there is a collective effort between the municipality, a mining company and the community on National Environmental Management Act compliance
- 59 % agree that there is a need for a collective effort on National Environmental Management Act compliance, and
- 82 % are interested in knowing about mining company application of the National Environmental Management Act.

**Table 27: Questionnaire responses on the National Environmental Management Act (RSA 1998)**

Academic ==> LEARNERS										
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3										
				Q1	Q2	Q3	Q4	Q5	Q6	Q7
Count Yes	49	40	3	49	40	33	34	27	85	130
Count Sometimes	20	21	<3	97	9	113	112	155	61	16
Count No	76	84	Checksum	146						
Count Others	1	1	3	34%	82%	23%	23%	18%	58%	89%
Check Sum	146	146	<3	66%	18%	77%	77%	106%	42%	11%
Fraction of entire population					6%					
GENERAL POPULATION										
				Q1	Q2	Q3	Q4	Q5	Q6	Q7
Count Yes	26	22	3	26	22	20	24	20	77	107
Count Sometimes	24	19	<3	105	4	111	107	111	54	24
Count No	80	88	Checksum	131						
Count Others	1	2	3	20%	85%	15%	18%	15%	59%	82%
Check Sum	131	131	<3	80%	15%	85%	82%	85%	41%	18%
Fraction of entire population					3%					
				100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				1.69	96	1.48	1.27	1.21	0.99	1.09
Significant difference at p = 0.05				Yes	Yes	Yes	Yes	Yes	No	Yes

#### 4.6.2.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population for Questions 1, 2, 3, 4, 5 and 7, which deal with:

- awareness of the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998) requirements in the community
- awareness of the National Environmental Management Act compliance in the community
- acknowledgement that a mining company has informed the community about the National Environmental Management Act requirements/ compliance
- acknowledgement that the municipality has informed the community about the National Environmental Management Act requirements/ compliance
- acknowledgement that there has been a collective effort between the municipality, a mining company and the community on the National Environmental Management Act compliance, and
- the interest in knowing about mining company application of the National Environmental Management Act.

#### 4.6.2.4 Comments

The National Environmental Management Act, Act No. 107 of 1998 (RSA 1998) is a framework for South African environmental legislation. Therefore, insufficient awareness of the National Environmental Management Act (RSA 1998) within a mining community is equivalent to no awareness. Analysed data show that both the learners and the general population are poorly aware of the National Environmental Management Act (RSA 1998), its application, compliance and requirements. This is an indication of the community's poor awareness of their environmental rights as enshrined in the Section 24 of the Constitution of the Republic of South Africa (RSA 1996c). Once parents are not properly aware, educated and informed about the National Environmental Management Act (RSA 1998), they cannot inform, advise, and educate their children about any environmental legal rights (*locus standi*) against mining companies. They cannot interrogate certain activities as they are not aware of their environmental rights. The same poor situation applies across the entire school going population who are at risk from any disaster, as the senior learners are not well informed and educated about the National Environmental Management Act (RSA 1998) and other environmental legislation. Further evidence is drawn from other data sources in the course of this research in Chapters 5 and 6.

#### 4.6.3 *Environment Conservation Act, Act No. 73 of 1989*

##### 4.6.3.1 Learners

The analysed data (Table 28) show that 61 % of the learners are aware of the environment and conservation. Of this 61 %:

- 68 % are aware of the Environment Conservation Act, Act No. 73 of 1989 (RSA 1989)
- 44 % are aware of how a mining company implements the Environment Conservation Act in the community
- 24 % agree that a mining company has informed the community about Environment Conservation Act compliance
- 24 % agree that the municipality has informed the community about mining company Environment Conservation Act compliance

- 18 % agree that there is a collective effort between the State, a mining company and the community in Environment Conservation Act compliance
- 61 % agree that there is a need for a collective effort on the Environment Conservation Act, and
- 82 % are interested in knowing about mining company Environment Conservation Act compliance.

#### **4.6.3.2 General Population**

The analysed data (Table 28) show that 56 % of the general population are aware of the environment and conservation. Of this 56 %:

- 53 % are aware of the Environment Conservation Act, Act No. 73 of 1989 (RSA 1989)
- 32 % are aware of how a mining company implements the Environment Conservation Act in the community
- 16 % agree that a mining company has informed the community about Environment Conservation Act compliance
- 16 % agree that the municipality has informed the community about mining company Environment Conservation Act compliance
- 24 % agree that there is a collective effort between the State, a mining company and the community in Environment Conservation Act compliance
- 68 % agree that there is a need for a collective effort on the Environment Conservation Act, and
- 78 % are interested in knowing about mining company Environment Conservation Act compliance.

#### **4.6.3.3 Comparing responses from the Learners and the General Population**

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 2, 3, 4, 5 and 7, which deal with:

- awareness of the Environment Conservation Act, Act No. 73 of 1989 (RSA 1989)
- awareness of how a mining company implements the Environment Conservation Act in the community



- acknowledgement that a mining company has informed the community about Environment Conservation Act compliance
- acknowledgement that the municipality has informed the community about mining company Environment Conservation Act compliance, and
- acknowledgement that there is a need for a collective effort on the Environment Conservation Act.

**Table 28: Questionnaire responses on the Environment Conservation Act (RSA 1989)**

Academic ==> LEARNERS												
			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3	Q8=3	
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Count Yes	94	64	3	94	64	41	36	36	28	94	125	
Count Sometimes	21	28	<3	59	30	53	117	117	125	59	28	
Count No	38	60	Checksum	153	94							
Count Others	0	1	3	61%	68%	44%	24%	24%	18%	61%	82%	
Check Sum	153	153	<3	39%	32%	56%	76%	76%	82%	39%	18%	
Fraction of entire population				20%								
GENERAL POPULATION												
				Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8=3	
Count Yes	79	36	3	68	36	22	19	19	29	83	95	
Count Sometimes	17	32	<3	54	32	46	103	103	93	39	27	
Count No	9	25	Checksum	122								
Count Others	3	12	3	56%	53%	32%	16%	16%	24%	68%	78%	
Check Sum	105	105	<3	44%	47%	68%	84%	84%	76%	32%	22%	
Fraction of entire population				26%								
				100%	100%	100%	100%	100%	100%	100%		
RATIO Academic: General				1.1	1.29	1.35	1.51	1.51	0.77	0.9	1.05	
Significant difference at p = 0.05				No	Yes	Yes	Yes	Yes	No	Yes	No	

#### 4.6.3.4 Comments

The data analysed show a potential disaster in the coal-mining community studied. It emanates from the differences between the learners and the general population. Inputs from the general population make the situation even more serious as they are less aware and informed than the learners about the environment and conservation. They are also less aware of the Environment Conservation Act, Act No. 73 of 1989 (RSA 1989) and any implications associated with this Act. Once parents are less aware, poorly informed and less educated, they stand the risk of not being able to advise, educate and inform their children of conservation needs and the existence of legislation to that effect. The same applies to the senior learners, who are not better equipped than their parents to avert a disaster. Further evidence is obtained from other data sources in Chapters 5 and 6.



#### 4.6.4 *Minerals Act, Act No. 50 of 1991*

##### 4.6.4.1 Learners

The analysed data (Table 29) show that 52 % of the learners are aware of the Minerals Act, Act No. 50 of 1991 (RSA 1991) in their community. Of this 52 %:

- 79 % are aware of mining company application of the Minerals Act
- 20 % agree that a mining company has informed the community about the application of the Minerals Act
- 19 % agree that the municipality has informed the community about the application of the Minerals Act
- 29 % are aware of the change of application of the Minerals Act (RSA 1991)
- 23 % agree that there has been a joint effort between the municipality, a mining company and the community in the application of the Minerals Act or changes, and
- 79 % are interested in knowing about mining company application of the Mineral and Petroleum Resources Development Act.

##### 4.6.4.2 General Population

The analysed data (Table 29) show that 58 % of the general population are aware of the Minerals Act, Act No. 50 of 1991 (RSA 1991) in their community. Of this 58 %:

- 65 % are aware of mining company application of the Minerals Act
- 26 % agree that a mining company has informed the community about the application of the Minerals Act
- 23 % agree that the municipality has informed the community about the application of the Minerals Act
- 34 % are aware of the change of application of the Minerals Act (RSA 1991)
- 24 % agree that there has been a joint effort between the municipality, a mining company and the community in the application of the Minerals Act or changes, and
- 75 % are interested in knowing about mining company application of the Mineral and Petroleum Resources Development Act.

**Table 29: Questionnaire responses on the Minerals Act (RSA 1991)**

Academic ==> LEARNERS			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3
			Take score 3 & above to indicate awareness & proceed further. Discard if less than 3							
				Q1	Q2	Q3	Q4	Q5	Q6	Q7
Count Yes	75	59	3	75	59	29	27	42	33	114
Count Sometimes	21	19	<3	70	16	116	118	103	112	31
Count No	47	67	Checksum	145						
Count Others	2	0	3	52%	79%	20%	19%	29%	23%	79%
Check Sum	145	145	<3	48%	21%	80%	81%	71%	77%	21%
			Fraction of entire population		11%					
GENERAL POPULATION				Q1	Q2	Q3	Q4	Q5	Q6	Q7
Count Yes	102	66	3	102	66	46	40	60	42	131
Count Sometimes	19	19	<3	73	36	129	135	115	133	44
Count No	51	87	Checksum	175						
Count Others	3	3	3	58%	65%	26%	23%	34%	24%	75%
Check Sum	175	175	<3	42%	35%	74%	77%	66%	76%	25%
			Fraction of entire population		21%					
				100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				0.89	1.22	0.76	0.81	0.84	0.95	1.05
			Significant difference at p = 0.05	Yes	Yes	No	No	No	Yes	Yes

#### 4.6.4.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 1, 2, 6 and 7, which deal with:

- awareness of the Minerals Act, Act No. 50 of 1991 (RSA 1991) in the community
- awareness of mining company application of the Minerals Act
- acknowledgement that there has been a joint effort between the municipality, a mining company and the community in the application of the Minerals Act or changes, and
- the interest in knowing about mining company application of the Mineral and Petroleum Resources Development Act.

#### 4.6.4.4 Comments

The data analysed show that general population are more aware about legal matters than the learners. This does not imply that the community is safe. As the general population response is low, it demonstrates that parents are not properly aware of the Minerals Act and its application or change of application. This implies there is a potential for disaster as parents cannot educate, inform and advise their children about the existence of the



Minerals Act and its application. More evidence is drawn from other data sources in this research in Chapters 5 and 6.

#### 4.6.5 *Mineral and Petroleum Resources Development Act, Act No. 28 of 2002*

##### 4.6.5.1 Learners

The analysed data (Table 30) show that 35 % of the learners are aware of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002) in their community. Of this 35 %:

- 68 % are aware of a mining company's application of the Mineral and Petroleum Resources Development Act in the community
- 29 % are aware of the change from the Minerals Act (RSA 1991) to the Mineral and Petroleum Resources Development Act (RSA 2002)
- 24 % agree that a mining company has informed the community about the application of the Mineral and Petroleum Resources Development Act
- 22 % agree that the municipality has informed the community about mining company application of the Mineral and Petroleum Resources Development Act
- 25 % agree that there is a joint effort between the municipality, a mining company and the community on the application of the Mineral and Petroleum Resources Development Act, and
- 84 % are interested in knowing more about company application of the Mineral and Petroleum Resources Development Act.

##### 4.6.5.2 General Population

The analysed data (Table 30) show that 35 % of the general population are aware of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002). Of this 35 %:

- 79 % are aware of a mining company's application of the Mineral and Petroleum Resources Development Act in the community
- 24 % are aware of the change from the Minerals Act (RSA 1991) to the Mineral and Petroleum Resources Development Act (RSA 2002)

- 22 % agree that a mining company has informed the community about the application of the Mineral and Petroleum Resources Development Act
- 19 % agree that the municipality has informed the community about mining company application of the Mineral and Petroleum Resources Development Act
- 20 % agree that there is a joint effort between the municipality, a mining company and the community on the application of the Mineral and Petroleum Resources Development Act, and
- 72 % are interested in knowing more about company application of the Mineral and Petroleum Resources Development Act.

**Table 30: Questionnaire responses on the Mineral and Petroleum Resources Development Act (RSA 2002)**

Academic ==> LEARNERS			Criteria	Q1=3	Q2=3	Q3=3	Q4=3	Q5=3	Q6=3	Q7=3
Take score 3 & above to indicate awareness & proceed further. Discard if less than 3										
				Q1	Q2	Q3	Q4	Q5	Q6	Q7
Count Yes	44	30	3	44	30	36	30	28	32	106
Count Sometimes	19	18	<3	82	14	90	96	98	94	20
Count No	61	77	Checksum	126						
Count Others	2	1	3	35%	68%	29%	24%	22%	25%	84%
Check Sum	126	126	<3	65%	32%	71%	76%	78%	75%	16%
Fraction of entire population				11%						
GENERAL POPULATION			Criteria	Q1	Q2	Q3a	Q4	Q5	Q6	Q7
Count Yes	62	49	3	62	49	42	39	34	35	129
Count Sometimes	19	18	<3	116	13	136	139	144	143	49
Count No	92	107	Checksum	178						
Count Others	5	4	3	35%	79%	24%	22%	19%	20%	72%
Check Sum	178	178	<3	65%	21%	76%	78%	81%	80%	28%
Fraction of entire population				7%						
				100%	100%	100%	100%	100%	100%	100%
RATIO Academic: General				1	0.86	1.21	1.09	1.16	1.29	1.16
Significant difference at p = 0.05				No	No	Yes	No	No	Yes	Yes

#### 4.6.5.3 Comparing responses from the Learners and the General Population

There are significant differences at  $p = 0.05$  level for the standard error, between the learners and the general population on Questions 3, 6 and 7, which deal with:

- awareness of the change from the Minerals Act (RSA 1991) to the Mineral and Petroleum Resources Development Act (RSA 2002)
- acknowledgement that there has been a joint effort between the municipality, a mining company and the community on the application of the Mineral and Petroleum Resources Development Act, and



- the interest in knowing about company application of the Mineral and Petroleum Resources Development Act.

#### **4.6.5.4 Comments**

The analysed data show a potential disaster in the community. There is evidence that the general population is less aware of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002); the changes made from the Minerals Act (RSA 1991) to the Mineral and Petroleum Resources Development Act (RSA 2002), and the new Act's application to the community. This implies parents are not aware of their environmental rights. For example, Section 100 of the Mineral and Petroleum Resources Development Act (RSA 2002) that identifies the rights of historically disadvantaged mining communities in South Africa and the need for sustainable mining communities is unknown. As for the learners, their understanding is no better than that of the general population. More evidence is derived from other data sources collected in Chapters 5 and 6.

The questionnaire results illustrate some level of awareness within the community by the learners and the general population. Individual results on awareness illustrate that learners are more aware than the general population by a narrow margin. By implication, the school curriculum has not made a satisfactory contribution to the level of awareness of learners as opposed to the general population. The long-term implication summed up from the general performance illustrates that the community is vulnerable. This is simply because parents are not well versed with the hazards associated with coal, from the mining phase to home burning. Therefore, they cannot advise and educate their children about the dangers of coal. To make things worse, approximately half of the senior learner population assessed is also ill informed about the hazards associated with coal. Therefore, they cannot protect themselves and the younger members of their community.

Having presented the data analysis and given an interpretation of the preliminary results, objective (vi) is dealt with in Chapter 5 (Results) in which a synthesis of the various objectives is made and the outcome of the quantitative research findings is presented.

#### 4.7 Conclusion

Chapter 4 analysis and provide a first hand result on the quantitative information collected using various manipulative techniques. The following manipulative techniques were used, a three scale value of -1, 0 and +1, a t-test for variance determining the mean and standard diversion. Numerical responses per question and subunit were further divided between the learners and the general adult population. Data was presented figuratively in percentages per question and on tables. At the end of each table, a discussion was given comparing responses of learners to that of the general population per question. Questions with significant differences at  $P=0.05$  level between the learners and the general population was further highlighted. A short analytical discussion concludes each questionnaire subunit, by examining the level of awareness between the learners and the general adult population. Inputs from open-ended questions were presented in pie charts and in percentages, with a short justification to the variation in responses.



## Chapter 5: RESULTS

*This chapter presents the outcome of the quantitative research findings. It presents the results of the multiple-choice questionnaires, the open-ended questions, direct quotations from voluntary comments, individual interviews and a focus group discussion. The direct quotations serve as the community voice in this research. They are also a satisfactory measure of the community level of awareness, education, and a measure of information and changes in behaviour and practices.*

### 5.1 Results of the Questionnaire Survey

Specific topics and techniques were used to analyse behavioural change, with category scores of awareness among the learners in schools and the general population in the community. These topics are grouped into two broad headings of direct and indirect awareness (Chapter 4). In addition to the direct and indirect quantitative data inputs, quotations are drawn from the open-ended questions, voluntary comments, individual interviews and a focus group discussion to add qualitative support to the argument.

Nineteen (19) structured questionnaires (Annexure 4) based on the sub-sections in Table 5 and summarised by topic and sub-topic (Annexure 7) were grouped into four main sections of:

- i health and safety;
- ii disaster preparedness and awareness response;
- iii strategic environmental management decisions/planning, and
- iv environmental legal application and compliance.

Results were presented per section. In the initial questionnaire-structuring process, it was hypothesised that the community would show a better understanding and thus provide more insightful input in health and safety; disaster preparedness and awareness response. The questionnaire responses were scored on a three-point scale of:

- +1 “Yes”, indicating “strong [agreement]”
- 0 “Sometimes”, indicating neither a “strong [agreement]” nor a “strong [disagreement]”
- 1 “No”, indicating “strong [disagreement]”



The following average absolute scores are used as determinants to interpret the results:

values  $\geq 2.5$  indicate highly [aware](Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4)  
/highly [interested] (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4);

values  $> 2.2$  and  $< 2.5$  indicate [awareness] (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4)  
/[interest] (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4);

values  $> 1.8$  and  $< 2.2$  indicate neutral (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4), and

values  $< 1.8$  indicate [unawareness] (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4)  
/[disinterest] (Section 5.1.1, Section 5.1.2, Section 5.1.3, Section 5.1.4).

An important evaluation of the data was to gauge differences in awareness between the learners and the general population to challenge the hypothesis that sustainability awareness has increased through the current educational exposure. Differences between the responses of learners and the general population are analysed based on a t-test analysis. Should the t-test (ratio of score to the standard deviation in the score) have a value  $\geq +3$ , it is interpreted as the difference between the learners and the general population being significant at the 95 % confidence level.

A t-test value for a two-tailed distribution can be either positive or negative, and hence it can be significantly high,  $\geq +3$ , or significantly low,  $< 3$ . A negative t-test is an indication of unawareness, implying learners are not better aware and informed through the current school curriculum than the general population and the community.

To better understand the impact of mine hazards on the mining community, thirteen open-ended structured questions were added to the multiple-choice questions. Twelve of the thirteen open-ended structured questions required a one-word, or a short sentence, response. Such responses created an in-depth understanding of the specific response, as there was no room for random, guessed responses. The only tick-box response in this category dealt with an already short sentence response such as: “Is the project *long-, medium-, short-term, or other?*” Any blank space is considered to be “abstained”, implying the respondent did not attempt an answer to the question. That, by itself, is considered an input implying *no idea at all*. An inappropriate response is also considered an answer to a question, as the respondent attempted an answer but got it wrong. Results are arranged per question heading and subsections.

Altogether 650 categorised voluntary comments were accepted in the entire research process (Table 6). Only selected and relevant comments are integrated as supporting evidence to qualify the community multiple-choice response per section and sub-section. Individual interviews and a focus group discussion were conducted on targeted members of the community and personnel. Only relevant points from the interview and the focus group discussion were integrated into this discussion. Results were presented per section heading.

### 5.1.1 *Health and Safety*

#### 5.1.1.1 Awareness on health and safety

The overall results on this sub-set of questions on awareness of **Health and Safety** (Annexure 7: Topic A) show *awareness*, with an overall average score of 2.22. Overall there is no significant difference between learners and the general population. In a set of nine questions, one question scored a *highly aware* response of 2.53 (Question A1: *awareness of dust coming from mines*); five questions (Questions A4, A5, A6, A7 and A8) show *awareness* with scores  $> 2.22$ ; two questions (Questions A2 and A9) show a *neutral* response with scores  $< 2.20$ , and one question (Question A3: *awareness of whether any mining company carries out dust control within the mining community*) shows *unawareness* with a score  $< 1.70$ .

Only Question A2 has a significant difference between the learners and the general population, with the general population indicating *unaware* (score 1.77) *of dust within the community attributed to mining activities*, while learners were *aware* (score 2.30), with the t-test value = 4.66. The lowest score per question is for Question A3 (1.56 for the learners and 1.77 for the general population), indicating *unawareness* that *a mining company carries out dust control within the mining community*.

#### 5.1.1.2 Information received via education

Probing into the source of awareness, the next sub-set of questions (Annexure 7: Topic B) verified the availability of information through education, either formal or informal. The overall average score (1.59) indicates *unawareness* which indicates that awareness on health and safety are not related to any form of educational knowledge derived through

formal channels. There was overall no significant difference between the learners and the general population, with consistent scores  $< 1.80$ .

In a set of eight questions (Questions B1 to B8), not one has a score  $> 1.80$ , indicating *unawareness*. The lowest average scored was 1.32 for Question B2 (1.33 for the learners and 1.31 for the general population), indicating *unawareness* that *the municipality has educated the community about the hazards of dust*.

This is an indication that schools and other channels have not been used as a conduit for informing and educating the community about health and safety issues. Conclusively, the school curriculum has not changed perceptions between the learners and the general population.

#### **5.1.1.3 Information received via industry or local government**

To reaffirm this argument that the community awareness on health and safety is not based on education, the next sub-set of questions tested awareness through information received from industry or local government (Annexure 7: Topic C). The overall average score (1.99) indicates a *neutral* response. This indicates a partial awareness of information received on health and safety from industry and local authorities. Four of eleven questions (Questions C3, C6, C9 and C10) indicate *awareness*, with scores  $> 2.20$ ; three questions (Questions C2, C8 and C11) indicate a *neutral* response (scores  $> 1.8$  but  $< 2.20$ ); and four questions (Questions C1, C4, C5 and C7) indicate *unaware* with scores  $< 1.80$ . There is no overall significant difference between the learners and the general population on this set of questions.

Two questions (Questions C3 and C6) were outstanding, with an average score of 2.27. Question C3 (score 2.28 for the learners and 2.26 for the general population) acknowledged that *workers are informed of coal dust and related diseases from coal dust*; while Question C6 (score 2.29 for the learners and 2.24 for the general population) also confirmed that *information has been provided to communities on the hazards of temperature and heat exposure*. The lowest average question (Question C4) scored 1.64 (1.67 for the learners and 1.59 for the general population), indicating *unawareness* of any *information provided to the community on the hazards of noise and vibration from mines*; this is interpreted as no evidence was received from industry or the municipality.

#### 5.1.1.4 Interest to acquire knowledge

While there was insufficient acknowledgement of information received, there was still a need to assess the *interest* to receive information if it is provided, which is dealt with in the next sub-set of questions (Annexure 7: Topic D). The overall average score (2.39) indicates *interest* to acquire knowledge. There was no significant difference in response between the learners and the general population. With the exception of Question D6 (1.68), the average score across the entire population was consistently  $> 2.40$ , indicating *interest* to receive information if it is provided.

The highest average score (2.63) was for Question D4 (2.62 for the learners and 2.64 for the general population), acknowledging *highly interested to know about mining company temperature and heat control measures*. Question D6 has an anomalously low average score of 1.68 (1.57 for the learners and 1.90 for the general population), with the learners being *disinterested* to receive information on *health hazards of coal and coal-related illnesses*.

From the general performance on this set of questions, it is certain that information would have been gratefully received if it had been provided to the community. This further confirmed that, although the community is *interested* to learn about coal hazards and health hazards, there was an inadequate flow of information from the mining industry and local authority to the community.

#### 5.1.1.5 Indirect evaluation of awareness derived through workers in industry

A third-party approach (as discussed in Section 3.1.1) through inputs from the mine workers, the learners and the general population (Annexure 7: Topic E) revealed the following outcomes: the overall average score (1.78) indicates *unawareness*. Thus, using third-party information, both the learners and the general population are *unaware* of the *health hazards of coal and coal-related diseases*. In a set of seven questions, only one (Question E1) had an average score  $> 2.22$ ; two questions (Questions E2 and E5) had average scores  $> 1.80$  but  $< 2.2$ , indicating neutral. Four questions (Questions E3, E4, E6 and E7) had average scores  $< 1.80$  indicating *unawareness*.

Two of the seven questions had significant differences between the learners and the general population for Question E4 ( $t = 3.97$ ) and Question E6 ( $t = 3.65$ ). Question E4 had an average score of 1.68 (1.82 for the learners and 1.39 for the general population),

indicating a significant difference, with the general population being *unaware* of *having suffered from any coal-related illness*. Question E6 had an average score of 1.57 (1.71 for the learners and 1.28 for the general population), indicating a significant difference: again, demonstrating *unawareness* that the general population *knows anyone who has suffered from a coal-related disease and who has worked in a coal-mining company*.

The highest average score was 2.27 for Question E1 (2.30 for the learners and 2.23 for the general population) which indicates *awareness* that *mine workers are sometimes tested for noise and vibration-related diseases*. The lowest average score was 1.43 for Question E7 (1.51 for the learners and 1.26 for the general population), in which the general population is *unaware of anyone in the community who had died from a coal-mining-related disease*.

The general response was attributed to a poor inter-relationship between industry and the community; lack of clinical reports on mining and community health; little information and communication exists, and existing health information is private. Conclusively, the community is *unaware* whether mine workers are better informed about coal hazards or tested for coal-related diseases.



#### **5.1.1.5 Information via personal observation**

To confirm that the community is *unaware*, and that the mine workers are not better informed and tested for coal and health effects, two questions (Annexure 7: Topic F) were structured to test personal observations. Questions F1 and F2 dealt with personal observation experiences. The overall average score (2.16) indicates *neutral*. There is no significant difference between the learners and the general population.

The highest average score (2.24) for Question F2 (2.22 for the learners and 2.28 for the general population) signifies *awareness* that the *community sometimes feels abnormal temperature and heat increases likely as a result of mining processes*. The lowest average score (2.08) for Question F1 (2.01 for the learners and 2.20 for the general population) indicates a *neutral* response on *the intensity of noise and obstructiveness to hearing*. By implication, not all learners and the general population are happy with their surroundings in relation to increases in temperature, noise and other health effects attributed to mining activities.

Conclusively, the major sources of community awareness on coal health and safety hazards are: (i) personal experience and (ii) personal observation, through seeing, hearing and touching. Other contributions through education are secondary, as neither education nor local authorities had created sufficient awareness among the community on health and safety of coal hazards. To confirm the personal experiences and personal observations, inputs from the open-ended questions were considered.

#### **5.1.1.6 Health and Safety – knowledge-based response**

On health and safety hazard awareness, one open-ended question was formulated to assess the community knowledge on gases. The question reads: *Which are the various gases known to your community?* A total of 586 responses was obtained (Table 36). The most well known gases in the community were nitrogen (359), carbon monoxide and carbon dioxide (89). There were no responses indicating knowledge of basic gases like sulphur dioxide, hydrogen sulphide or nitrogen oxides. There were also a substantial number of inappropriate responses (76) (for example, coal, cancer, sinusitis, tuberculosis, N/A) that are not applicable to the question and abstentions. This was further evidence that the community is not aware of common pollutant gases, other than the gases identified above. The most common gas of life, oxygen, was never mentioned.

The outcome of the above responses on known gases prompted a new probing into the community relationship with stakeholders. This is a nationally identified high air pollution area, as determined by a Government Notice (Highveld Priority Area Air Quality Management Plan) (reference to the notice in government gazette of 2 March 2012) in terms of the National Environment Management: Air Quality Act, Act No. 39 of 2004 (RSA 2004). Therefore, it is expected that people living in such a highly polluted area (eMalahleni Municipality) would be informed. By implication, one would have expected the local authority in one of its divisions (environmental department) or that the local industry would have created awareness. However, from the questionnaire responses and the open-ended question, this aspect of the environment has not been conveyed by the local authority and any information from industry had not reached the community.

Three open-ended questions were structured on health and hazards (Questions 2, 4, and 6). The questions read: (Question 2) *State any coal-related diseases that you know of.* (Question 4) *State any coal-related disease that you have suffered from.*

(Question 6) *State your relationship with a person who has suffered from a coal-related disease* (Table 16). Responses are distributed in hierarchy.

Question 2 had a total score of 116 responses distributed in order of frequency as: sinusitis (50), inappropriate response (21), tuberculosis (15), cancer (13), asthma (7), bronchitis (5), and ‘*I don’t know*’ (3). Examples of *inappropriate responses* are: “*because I know about the smoke*”, “*coal environment*”, “*noise and others*”.

Question 4 had a total of 100 responses. The responses are distributed as: sinusitis (46), inappropriate response (24), tuberculosis (8), coughing blood (6) and asthma (4) (Table 16). Again sinusitis was the most common coal-related disease suffered by the community. Inappropriate responses included: “*because they used to burn coal, old food and dirty plastic*”, “*coal hazard*”.

Question 6 had a total of 100 responses. The scores are distributed as: inappropriate response (27), uncle (15), friends (12), brothers (12), father (6), neighbour (5) and mother (4) (Table 16). Inappropriate responses constitute: “*We’ve got such a good relationship with the person*”; “*He lives next to my home*”, “*...is to make good relationship with the person*”.

Comparing the total results of Question 2, Question 4 and Question 6, there is drop in the number of responses with fewer responses being provided in successive questions. This warrants probing, especially as all three questions appeared consecutively on the same questionnaire form. By expectation, every respondent should respond to all three questions, or to none. Comparing the total score of Question 2 to that of Questions 4 and 6, one could see some element of shyness and lack of confidence among the respondents. This was an indication that the respondents were not sure of their confidentiality, irrespective of repeated assurances of privacy. Therefore, there was reticence to state one’s health status or that of a relative. In this regard, inappropriate responses and abstentions may not be related to lack of information, but possibly an unwillingness to provide confidential information or family-related information.

All in all, it is evident that awareness on health and hazards was not based on specific information from either the industry or the local government. It was derived through personal experiences and the observed health-related effects of relatives, friends and neighbours. Community dwellers were able to identify several common respiratory

diseases from which they had suffered and which they attributed to coal-related causes. The most common of these diseases were sinusitis, asthma, cancer and coughing blood. Even respondents who had not personally suffered from these common diseases knew a family member or a friend who had suffered from at least one of these diseases. This conclusive remark was qualified by selected voluntary comments.

#### **5.1.1.7 Health and Safety – voluntary comments**

Voluntary comment responses are separated per heading to distinguish the various grievances. From these responses, one can deduce areas of severe problems and unidentified hazards<sup>12</sup> in the community. Final analyses are drawn per section, integrating the various individual responses into a single conclusion.

#### **5.1.1.8 Dust exposure**

On dust awareness, a 45-year-old parent, who has resided in the community for 15 years, wrote:

*Company must educate the community about the risk the dust carries to [their] lives, so that measures can be taken to prevent that.*

This was confirmed by a 30-year-old mining engineer who has resided in the community for 14 years:

*The [mining] company isn't working through the problem properly and immediately, so that the pollution can be reduced ... while there's still enough time.*

A 35-year-old educator, who has resided in the community for three years, also agrees:

*The community is aware of the air pollution caused by mines ... but they don't have control over it. The municipality of eMalahleni is doing nothing about it.*

A 17-year-old learner who has resided in the community for 17 years added:

*... companies didn't give us full information about coal dust. And we are interested to know about the dust-related diseases.*

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<sup>12</sup> Unidentified hazards refers to potential hazards that were not covered in the structured level-one and open ended questionnaires. It includes personal experiences observed and other comments such as cracks on the wall of houses.



This was followed by a 57-year-old domestic worker, who has resided in the community for 17 years, who observed:

*... it is not only the dust of coal that is dangerous to the community, even the dust from the soil. ... the streets are not covered with paving or tar, so the cars make more dust on dry soil. The State should take care of that, too.*

A 40-year-old mine officer, who has resided in the community for 12 years, concluded:

*... we need to improve our community by not using coal because it causes many diseases like cancer and it kills our community. We must work together fighting for not using coal in our community.*

#### **5.1.1.9 Noise and Vibration exposure**

Concerning industrial noise and vibration, a 40-year-old housewife, who has resided in the community for 15 years, wrote:

*...our building cracks because of vibration.*

This was confirmed by a 38-year-old mine officer who has resided in the community for 15 years and who wished to remain anonymous:

*As a community, we need to be informed about noise and vibration from mines.*

A 35-year-old cashier/supervisor, who has resided in the community for 17 years, also confirmed:

*...company should try to figure better machines to operate without noise and vibration that [have] bad infection to the country.*

A 17-year-old learner, who has resided in the community for eight years, also remarked:

*Mining companies don't look after the community, they just look at themselves. They don't care if you [are] sick or okay.*

Another 17-year-old learner, who has resided in the community for eight years, confirmed:

*As a community, we must always be aware of the noise and vibration of the mining so that we can be safe all the time.*

Another 17-year-old learner, who has resided in the community for 17 years, added:

*They are hurting because some of us have problems of nerves and our houses are falling apart because of the vibrations.*

To make things even more apparent, a 59-year-old pensioner who has resided in the community for 11 years, explained:



*I'm living close to one of the mines. My house has cracks already from the vibrations. Something must be done about this.*

Another elder, a 44-year-old resident who has resided in the community for 4 years wrote:

*We would be very glad if the State and the mines [can] conduct some workshops to educate the community about the noise and vibration. Even to test people. Maybe others are already affected with some diseases related to noise, high temperature and vibration.*

#### **5.1.1.10 Temperature and heat exposure**

Relating to diurnal temperature and heat exposure, a 46-year-old managing director who has resided in the community for 15 years wrote:

*We need more information [data] about the heat exposure, heat control measures and the hazard of temperature etc.*

Agreeing with the first respondent, a 30-year-old housewife who has resided in the community for five years noted:

*It will be great pleasure if the State or companies educate and inform the community about temperature, heat and gases.*

In line with the above respondents, a 70-year-old welder who has resided in the community for 10 years summarised:

*The heat caused us skin cancer.*

To conclude along this line, a 21-year-old health and safety officer who has resided in the community for 14 years conceded that:

*If we can work together with the big companies and factories, the communities will be able to know about the heat and temperature and how to prevent it.*

#### **5.1.1.11 Coal-mining and coal-processing gases**

To further concur with the impact of coal-mining and coal-processing gases as hazards, a 17-year-old learner who has resided in the community for 17 years stated:

*I think the mine owners should at least a month teach people about coal gases happening and make sure they are not harmed.*

This was amplified by a 37-year-old childcare worker, who has resided in the community for 17 years, who wrote:



*The State must provide our community with information of dangerous hazards of coal-mining gases.*

Aggravating matters further is the rather harsh response from a 17-year-old learner, who has resided in the community for 17 years, who wrote:

*They must close all mines near to the people's houses.*

#### **5.1.1.12 Health and hazards exposure**

As a matter of coal hazards on health (health hazards) awareness, a comment from a 29-year-old trainee educator, who has resided in the community for seven years states:

*The [mining] company must be responsible to the communities and ensure that health and safety standards are well maintained within the communities.*

Another educator of 32-years-old, and who has resided in the community for 25 years, concurred:

*The companies should invest substantial amount of money on educating communities about their health conditions with regard to coal.*

To conclude along the same line of thought, an 18-year-old learner who has resided in the community for 18 years agrees:

*I think the government is not doing enough on educating people about coal-related sickness. Most people are killed by coal [-related] diseases.*

These voluntary comments show from every indication that health and safety awareness is high. The community responses further show that residents are aware of common and existing hazards such as dust, noise and vibration, the effects of high temperature, and some possible health effects (diseases). While respondents are aware of the effects of these hazards on health, the extent of their knowledge is limited, as they are generally not highly educated (based on socio-economic circumstances of this community). From the evidence presented they do not appear to have received information from an industry or responsible authorities. A good example is the poor awareness of coal gases and other gases that constitute the atmosphere. This further explains the poor responses to most open-ended questions. For example the only open-ended question on gases, shows a very high response on nitrogen gas, as a known gas in the community in comparison to other more serious pollutant gases. In reality nitrogen is not a pollutant gas; rather nitrogen oxide is a pollutant gas. Oxygen, which is the gas of life, was omitted.

In identifying some health effects such as diseases, respondents are sure that these hazards are harmful to the community health and assign all faults to the industry for poor communication, no information and education. Respondents identified common coal-related diseases (such as sinusitis, cancer, coughing blood and influenza), but were unwilling to associate themselves with these diseases and did not want to identify family members and friends who had suffered from such a disease. One can perceive that a low self-identification response was responsible.

### 5.1.2 *Disaster Preparedness and Awareness Response*

#### 5.1.2.1 Awareness of issues on disaster preparedness and awareness response

The overall average score (2.11) for this sub-section on **Disaster Preparedness and Awareness Response** is a *neutral* response, which implies the population is partially aware of disaster-preparedness measures in their community. By implication, they are not aware of any disaster-preparedness measures for coal hazards. Average scores per question are distributed as: one question (Question A1) has a value  $> 2.50$ , indicating *highly aware*; two questions (Questions A6 and A8) have scores  $> 2.20$ , indicating *awareness*, and nine questions (Questions A2, A3, A4, A5, A7, A9, A10, A11 and A12) have *neutral* scores  $< 2.2$  but  $> 1.80$ .

There is no significant difference in response between the learners and the general population on any question in this sub-set. Conclusively, there is some awareness and some community mitigation steps on coal hazards.

The highest average score was 2.58 on Question A1 (2.58 for the learners and 2.58 for the general population), indicating *highly aware of coal fires in the community*. The lowest average score (1.81) was for Question A4 (1.77 for the learners and 1.86 for the general population) indicating a *neutral* response with the learners being unaware of *mining company fire-fighting equipment in the community*. There is an indication of coal fire hazards, but the community is partially aware of any measures in place to combat the coal fires. However, there is a divided opinion about the general level of awareness. Therefore, more probing is needed to confirm sources of awareness.

### 5.1.2.2 Information received via industry or local government

To confirm the above neutral response, the next sub-set of questions (Annexure 7: Topic B) was structured to confirm the role of industry and the local government in providing information in the researched community. The overall average score (1.67) indicates *unawareness*. This implies that information has not been received from a mining industry or local government. The average score for the entire population is consistently low (< 1.8). This is an indication that the community is *unaware* of information from industry or local government on disaster-preparedness measures and awareness response.

In a set of nine questions, only Question B1 shows a significant difference ( $t = 4.12$ ) between the learners and the general population. Question B1 (1.70, representing 1.86 for the learners and 1.50 for the general population) indicates *unawareness* that *a mining company has informed the community about fire-fighting efforts*. Question B1 shows a vast difference of opinion between the learners and the general population. Question B6 (1.54) has the lowest average score, indicating *unawareness* that *a mining company has informed the community about the use of explosives in mines*. With a generally low response per question in this section, there is a need to verify perceptions of the respondents about whether information was provided.

### 5.1.2.3 Interest to acquire knowledge

The next sub-set of questions (Annexure 7: Topic C) probed the community's interest to receive information if provided. The overall average score (2.55) a *high interest* to receive information. One question (Question C5) had an average score of 2.60; four questions (Questions C1, C2, C3 and C6) had scores > 2.50 and one question (Question C4) has a score of 2.49. There was overall a *high interest* response in five questions.

Three of six questions had significant differences between the learners and the general population Question C1 ( $t = 3.94$ ), Question C2 ( $t = 3.94$ ) and Question C3 ( $t = 3.75$ ). Question C1 (average score 2.58) (2.72 for the learners and 2.41 for the general population), indicates a *high interest to know about the hazards of coal fires*.

Question C2 (average score 2.58) (2.72 for the learners and 2.41 for the general population), also illustrates the learners' *high interest to know how a mining company combats coal fires*.



Question C3 (average score 2.56) (2.68 for the learners and 2.36 for the general population), also shows the learners' *high interest to know about mining company air-quality monitoring*.

The highest average score (2.60) for Question C5 (2.69 for the learners and 2.50 for the general population), indicates a *high interest to know how a mining company protects the community from the hazards arising from the use of mine explosives*.

The lowest average score (2.49) for Question C4 (2.53 for the learners and 2.44 for the general population), indicate *interest to know about the hazards of explosives*.

The high *interest* response is an indication of the willingness to receive information if provided.

An inference to the *high interest* to receive information indicates that information on hazards and hazard mitigation measures was not provided to the community. Had information been provided; it would have been met by a receptive audience. This is an indication of the level of information supplied by the mining industry and responsible authorities in this community. Alternatively, information was inappropriately channelled and did not reach the community. Schools could have served as the most appropriate channels of communication between the mining companies and the community. However, the *high interest* from the learners is an indication of openness to receive information, demonstrating the potential effectiveness of this channel.

Further probing is necessary to verify third-party awareness to conclude the initial source of community awareness on disaster preparedness and awareness response.

#### **5.1.2.4 Indirect evaluation of awareness derived through workers in industry**

To confirm the extent of community awareness on mining activities and information transfer, a third-party approach was adopted by testing community awareness through interactions with mine workers, retired mine workers and members of the community. There was a reasonable belief that mine workers should be more aware of mine hazards and mining activities than the general population. If that is true then the interactions with mine workers, family members, relatives and friends over the years will provide information on some of the hazards and mitigating measures emanating from mining measures so far implemented.



This assessment technique (Annexure 7: Topic D) shows an overall average score of 2.25, indicating *awareness*. By implication, mine workers are aware of some hazards of mining and have shared knowledge with the community. There is no significant difference between the learners and the general population for any of the questions.

In a set of five questions, the average scores were consistently  $> 2.0$ . Three questions (Questions D1, D2 and D4) have scores  $> 2.20$  indicating *awareness* and two questions (Questions D3 and D5) have scores  $> 2.10$ , indicating a *neutral* response. This indicates that the community perceives that mine workers are more aware of coal hazards and possible mitigation measures.

The highest average score (2.33) was for Question D1 (2.29 for the learners and 2.38 for the general population), indicating *awareness* by the general population that *mine workers from their community are aware of the hazards of coal fires*.

The lowest average score (2.15) was for Question D3 (2.09 for the learners and 2.22 for the general population), indicating a *neutral* response by the general population that *workers from their community are aware of the hazards of mine explosives*. From these responses, it is certain that some information exists within the community and that this information was obtained from mine workers, families and community interactions.

Conclusively, the community is aware of coal hazards and possible disaster-preparedness measures. This awareness is linked to community interactions with mine workers, families and friends. There is a lack of information from a reliable source such as an industry and local government. Further evidence proved that poor knowledge does not amount to unwillingness to receive information. This community is *interested* to receive information and awareness is largely obtained through community interaction with mine workers. More on this discussion is inferred from the voluntary comments quoted below.

#### **5.1.2.5 Voluntary comments on disaster preparedness and awareness response**

In the absence of open-ended questions in this section, voluntary comments were collected to assess general aspects that were not covered during the multiple-choice questionnaire process and to assess the community's knowledge on hazard awareness and mitigation steps executed by the industry, the responsible authority and the community. Only relevant comments are analysed in relation to specific sub-sections to produce meaningful results.

### 5.1.2.6 Coal fires and fire-fighting equipment

Coal fires are a common hazard observed on many mine sites and mine tailings. It is expected that both the learners and the general population would be aware of coal fire hazards in different ways. To confirm this perceived knowledge, a 17-year-old learner who has resided in the community for 17 years wrote:

*Our environment is full of smoke and the mining [industry] are not doing anything about that.*

This remark is reinforced by a 51-year-old educator who has resided in the community for 47 years:

*As a community, we would like the mining companies to take care of those people who are affected/fell sick due to coal gases and smoke together with the dust that we inhale around.*

A 42-year-old mine worker who has resided in the community for 11 years concurred:

*I think the community will appreciate the learning or to be informed about coal fires/fighting equipment as they will understand how to protect themselves and the danger it may cause, more especially the mine explosives.*

Another mine worker, 47-years-old who has resided in the community for five years, agrees:

*This is a straight-forward comment that people need to be trained in order to fight fire; no-one can do that without a [sic] proper training. All people must know how to fight and [about] the use of fire equipment.*

A 48-year-old safety officer who has resided in the community for 15 years also noted in same vein:

*Communities [are] to be made aware of all hazards on the coal mine. Health and safety are the key points as we all know health and safety and environment lead us to zero accidents.*

Photographic images are used to illustrate the impact of coal fires (spontaneous combustion), on the local community landscape and the effects of inadequate awareness and training processes are discussed in Chapter 6.



### 5.1.2.7 Explosives and explosions

By perception, the community is aware of explosives and further aware that explosives are used in coal mines during the extraction phase. Therefore, it is expected that respondents will give personal and observed experiences about explosives. To assess this assertion, a 40-year-old educator who has resided in the community for 18 years wrote:

*[The] community doesn't know anything about explosives. We would appreciate if the mines could inform the community about the dangers of explosives.*

In the same light, a 33-year-old mine worker, who has resided and worked in the community for six years and who wished to remain anonymous, agrees:

*The mines never tell [us] about explosives to cause [sic] harm. They open the mines and ask the people to work in the mines, they inform workers only, not communities.*

A 36-year-old unemployed adult who has resided in the community for 10 years also agrees:

*We are getting sick of the dust and the dirty water caused by the mines. Our houses are shaking and cracking from mine explosives.*

Paradoxically, an 18-year-old learner who has resided in the community for 18 years disagrees:

*When the mines want to do an explosion, they tell us, even if you were driving your car, they will stop you and sometimes when they explode our houses start to shake.*

### 5.1.2.8 Air-quality monitoring

As the atmosphere is vital for life so is the quality of the air. In these communities it is expected that learners and the general population will be eager to comment about the air from personal observation and the proximity of residences to heavy metal industries. To concede this pre-knowledge, a 30-year-old unemployed adult who has resided in the community for 12 years, and who wished to remain anonymous, wrote:

*Many people in eMalahleni suffer with breathing problems (sinusitis and asthma), some have eyes [sic] problems because of the explosives and smoke from the mines that causes air pollution.*



This comment aligns with the observation of a 36-year-old unemployed adult who has resided in the community for 10 years:

*The dust [generated] by explosives causes lung infections like TB, asthma. We are always sick because of air pollution in our area. Our houses are always dirty. It's not safe for us but who cares?*

A 43-year-old housewife who has resided in the community for 18 years concurred:

*We are staying next to companies which are polluting the air. There is no health and safety measures to live next to these companies.*

Added to the above comment is the remark of a 40-year-old educator who has resided in the community for 18 years:

*The community is aware that the air is polluted but they need more clarity as to how to prevent themselves from being affected by [bad] air.*

A 50-year-old ward councillor who has resided in the community for 25 years concurred:

*I hope the pressure must be put on government and factories and mining for this pollution as it is dangerous to the human.*

Photographic evidence of some initiated projects on air-quality monitoring is included in Chapter 6.



#### **5.1.2.9 Underground surveillance**

Relating to underground mining and surveillance, a 17-year-old learner who has resided in the community for 17 years commented:

*The underground company must talk to the community about the damage of the place so we should know whether the place is good to us.*

A 20-year-old learner who has resided in the area for 20 years agrees:

*I'm interested to know about company surveillance in mining so that I will be able to inform others in my community.*

From the selected voluntary comments cited, only one respondent, an 18-year-old who has resided in the area for three years, disagrees with the entire community about the mining company actions. The learner, though not in full support of the mining company actions on the use of explosives and their vibration impact on houses, acknowledged that the mining company often informed residents around the area of operations and especially motorists.

Results show that the community is aware of the negative consequences of coal and associated hazards. Some good comments were made by identifying the health effects. Most of the comments pointed fingers at the mining industry. Fewer comments identified the municipal authority, whilst none identified the other responsible authorities regarding the lack of information, education and preventive measures. No-one saw a potential disaster looming from the cumulative effects of coal hazards from the poor communication between stakeholders. To aggravate the situation, though the community is aware of the hazards associated with coal, and is able to identify by name some consequences like cracked buildings and the smoky atmosphere, no preventive steps or preparedness measures have been put in place by the community themselves.

### 5.1.3 *Strategic Environmental Management Decisions/Planning*

#### 5.1.3.1 Awareness issues on strategic environmental management decisions/planning

The overall average score (1.99) on this sub-set of questions (Annexure 7: Topic A) on **Strategic Environmental Management Decisions/Planning** is a *neutral* response. In a set of nine questions, three questions (Questions A1, A8 and A9) have scores > 2.20 indicating *awareness*. Three questions (Questions A3, A4 and A7) have scores > 1.80 indicating a *neutral* response. The three remaining questions (Questions A2, A5 and A6) have scores < 1.80, indicating *unawareness*.

Two questions (Questions A1 and A8) have *high awareness* with scores > 2.40. Question A1 with an average score of 2.49 (2.57 for the learners and 2.38 for the general population), indicates that the learners and the general population are *aware of mining hazards that surround their community*.

Question A8 with an average score of 2.43 (2.56 for the learners and 2.32 for the general population), indicates the learners are *more aware of the risk in mining as hazards* than the general population.

Four questions (Questions A3, A4, A5 and A7) show significant differences ( $t = 3.48$ ,  $t = 3.38$ ,  $t = 3.38$  and  $t = 4.20$ , respectively) between the learners and the general population. In all four questions, the general population shows *unawareness* with scores < 1.80. The response per question shows respectively:



Question A3 with an average score of 1.95 (2.14 for the learners and 1.76 for the general population), indicates that the general population is *unaware* of *environmental research and development in their community*.

Question A4 with an average score of 1.82 (2.02 for the learners and 1.64 for the general population), indicates the general population is *unaware* of *environmental research on identification of hazards*.

Question A5 with an average score 1.79 (1.98 for the learners and 1.60 for the general population), indicates that the general population is *unaware* of *a mining company purchasing new equipment in their community*, and

Question A7 with an average score of 1.85 (2.09 for the learners and 1.59 for the general population), indicates that the general population is unaware of *monitoring and control activities in their community*. This result led to further probing.

#### **5.1.3.2 Information received via education**

To verify the source of the *partial awareness* response, one question (Question B1) was structured to probe whether the partial awareness is related to information received through education. The result was *unaware*, with an overall average score of 1.45. There was no significant difference between the learners and the general population. Both the learners (1.56) and the general population (1.34) have scores < 1.80, indicating *unawareness* that *a mining company has educated their community on the use and value of hazard equipment*.

By implication, there is strong support that scant information was made available to the community through education. Therefore, other options were considered.

#### **5.1.3.3 Information received via industry or local government**

To further verify the *neutral* response on strategic environmental management decisions/planning, the next sub-set of questions (Annexure 7: Topic C) was structured to confirm whether the community received information directly from industry or local government. The overall average score (1.52) shows *unawareness*. In all seven questions, the scores are consistently low, with an average score of < 1.80.

In a set of seven questions, four questions (Question C4, C5, C6 and C7) have significant differences between the learners and the general population ( $t = 5.92$ ,  $t = 4.08$ ,

$t = 4.89$  and  $t = 3.93$ , respectively). In all four questions, the general population is *unaware* of receiving information from a mining company or a local authority.

Question C4 with an average score of 1.47 (1.77 for the learners and 1.16 for the general population), indicates that the general population is *unaware of a company ever informing their community about monitoring and control activities for hazards*.

Question C5 with an average score of 1.62 (1.85 for the learners and 1.39 for the general population), indicates that the general population is *unaware of the municipality ever informing the public about the need for a mining company to monitor and control hazardous activities in their communities*.

Question C6 with an average score of 1.76 (2.05 for the learners and 1.46 for the general population), indicates that the general population is *unaware of their community being informed that mining is a hazard to the community in some way*.

Question C7 with an average score of 1.54 (1.78 for the learners and 1.35 for the general population), indicates *unawareness of being informed of company efforts to improve risk and hazard-prone practices*.

The highest average score was 1.76 for Question C6 (2.05 for the learners and 1.46 for the general population), indicating *unawareness*. The lowest average score was 1.36 for Question C3 (1.51 for the learners and 1.22 for the general population), indicating *unawareness that the municipality has informed their community about existing and new company equipment for hazard management*.

This further confirms that community awareness about strategic environmental management decisions/planning is not related to information received from industry or local government and, even worse, the general population is barely aware of industry's strategic environmental management decisions/planning. More probing was then done via communication links.

#### **5.1.3.4 Communication links**

The next sub-set of questions (Annexure 7: Topic D) seeks to verify the *neutral* response regarding communication links between industry, the community and the State on environmental management decisions/planning. The overall average score (1.64) indicates



*unawareness*. The average score per question was consistently  $< 1.80$ , indicating *unawareness*.

In a set of three questions, Question D3 with an average score of 1.74 (2.04 for the learners and 1.49 for the general population) has a significance difference ( $t = 4.79$ ) between the learners and the general population. Question D3 demonstrates that the general population is *unaware of a communication link between the community and the State on risk and hazards from mining*.

The lowest average score (1.59) was for Question D1 (1.69 for the learners and 1.43 for the general population), indicating *unawareness of a communication link between their community and a mining company*.

The response shows that the community is *unaware* of the existence of such cooperation between the community, industry and the State. This resulted in further probing into the perception of the source of information.

#### **5.1.3.5 Interest to acquire knowledge**

With the consistent rejection of any source of awareness on strategic environmental management decisions/planning by the community, there was a need to verify the community's behaviour if information was made available. The next sub-set of questions (Annexure 7: Topic E) probes whether the community dwellers would be amenable to receiving information. The overall average score (2.54) shows *highly interested* to receive information. The average score per question was consistently  $> 2.40$ , showing *interest* to receive information. There was no significant difference between the learners and general population in any of the questions.

In a set of four questions, the lowest average score was (2.46) for Question E1 (2.41 for the learners and 2.50 for the general population), demonstrating the learner and general population are *highly interested to know about environmental research on hazard management in their community*. The *high interest* to receive information is an indication that information is lacking within the community. Therefore, unawareness is not related to unwillingness to receive information but rather to the unavailability of information. This *interest* to receive information was probed further.

### 5.1.3.6 Company project initiatives

Further evidence was needed to verify and justify the *neutral* of the community on strategic environmental management decisions/planning. The next sub-set of questions (Annexure 7: Topic F) was structured to verify the ‘*how*’, with expectations that information has come from industry-initiated projects in the community. The overall average score (1.53) shows *unawareness*. This is a strong indication that the community’s *neutral* response is not based on industry-initiated projects. The average score per question was < 1.80, indicating *unawareness*.

In a set of six questions, three questions (Questions F4, F5 and F6) show significant differences ( $t = 3.63$ ,  $t = 3.91$  and  $t = 4.96$ , respectively) between the learners and the general population.

Question F4 with an average score of 1.51 (1.70 for the learners and 1.33 for the general population), shows *unawareness* of *any projects on hazards undertaken by a mining company in the community’s interest*.

Question F5 with an average score of 1.45 (1.68 for the learners and 1.26 for the general population) shows *unawareness* that *any project was undertaken by a mining company on community risk and hazard prevention*.

Question F6 with an average score of 1.53 (1.84 for the learners and 1.27 for the general population), shows the general population is *unaware* of *any co-project being undertaken by the community, the State and mining companies on risk and hazard management*.

The low average score was consistently < 1.80, with the general population *unaware* of any industry-initiated projects. The highest average score (1.67) for Question F2 (1.70 for the learners and 1.61 for the general population), indicating *unawareness*. The lowest average score (1.45) was for Question F5 (1.68 for the learners and 1.26 for the general population), indicating *unawareness*.

By implication, industry has not initiated projects in the community. More verification was needed.

### 5.1.3.7 Participation via project initiatives

Further evidence of awareness was verified through participatory involvement in initiated projects. The next sub-set of questions (Annexure 7: Topic G) was structured to verify awareness through community participation. The overall average score (1.52) indicates *unawareness of any community participation in industry-initiated projects*. The average score for the entire sub-section was  $< 1.80$  indicating *unawareness*.

In a set of five questions, three questions (Questions G2, G4 and G5) show significant differences ( $t = 3.39$ ,  $t = 5.41$  and  $t = 4.31$ , respectively) between the learners and general population.

Question G2 with an average of 1.53 (1.66 for the learners and 1.33 for the general population), indicates *unawareness of community participation with a mining company on environmental hazard decisions*.

Question G4 with an average of 1.59 (1.89 for the learners and 1.28 for the general population), indicates that the general population is *unaware of their community being involved in any mining company monitoring and control activities for hazards*. Coincidentally, the highest score was for Question G4.

Question G5 with an average of 1.52 (1.75 for the learners and 1.27 for the general population), indicates *unawareness that the municipality has ever taken part in community monitoring and control activities for hazards*. Coincidentally, the lowest score was for Question G5.

It is certain that the community is *unaware* and has not participated in any project initiated by an industry or local government on strategic environmental management decisions/planning. There is doubt whether industry- or municipality-initiated projects ever existed. If they do, then the community is *unaware* and did not participate in the projects. This doubt can be clarified by personal observation.



#### **5.1.3.8 Personal observation**

With the general low response in strategic environmental management decisions/planning, personal observation and experience was tested as a means of awareness. Two questions (Annexure 7: Topic H) were structured with an overall average score of 1.31 for the entire sub-section. This average score per question was < 1.80, with no significant difference between the learners and the general population, indicating *unawareness*.

The highest average score (1.32) was for Question H1 (1.40 for the learners and 1.19 for the general population), indicating *unhappiness with their surroundings*.

The lowest average score (1.31) was for Question H2 (1.47 for the learners and 1.14 for the general population), indicating *unawareness of environmental research on hazard management in their community*.

It was certain that the community is *unaware* of any strategic environmental management decisions/planning. This is related to poor communication between the responsible authorities and the community. Educational institutions (such as schools) which are potential channels for dissemination of knowledge are not deployed as links of communication. These and other factors are the causes of the *unhappiness* of the community. More probing was needed using open-ended questions and other sources.

#### **5.1.3.9 Knowledge-based response on strategic environmental management decisions/planning**

Strategic environmental management decisions/planning had eight open-ended questions, as the central purpose of this research is to assess industrial activities and managerial decisions in relation to community environmental care. Each sub-section had an open-ended question to assess community awareness about managerial decisions using various techniques and a third-party approach. One questionnaire (environmental hazard and planning decisions) had four open-ended questions (Questions 4, 5, 11 and 13). Question 13 was divided into two sub-questions.

Question 4 requested respondents to *name two coal-mining hazards known to the community*. A total of 91 responses were obtained. The most important hazards identified were air pollution (33), dust (10), earth trembling (8), smoke (7), underground combustion

(6), water pollution (6), diseases (6) and noise (4) (Table 41(c)). Eleven scores of  $< 4$  were regarded as insignificant and discarded.

Question 5 required respondents to *identify personal interest in relation to the hazards identified in Question 4*. A total of 104 responses were received. The responses were distributed as: relocate (36), preventive measures (22), education (11) and health check (7) (Table 41(c)). Twenty-eight responses of different category  $< 4$  were regarded as insignificant and discarded. Relocation was the most outstanding option to the community. Below are random comments selected from five respondents which were determined as *relocate* read:

*They [mining companies] must go away from community.*

*The mines must close down and find another place to mine.*

*They must be far from us.*

*Mines should be cautioned and drastic steps taken against them.*

*They must be away from residential areas.*

Question 11 requested the community to *name two projects initiated by a mining company in the community*. A total of 60 respondents participated with the following responses: education (15), health checks (11), providing bursaries (10), building schools (8), clearing the area (6) and road construction (4) (Table 41(c)). Six responses for different categories  $< 4$  were regarded as insignificant and discarded. The most significant responses regarding initiated projects concerned education, health checks, providing bursaries to merit-worthy learners and building of schools.

Question 13 requested respondents to identify two *aspects that are pleasing and unpleasing in the community environment*. The responses were split as pleasing (a) and (b) and unpleasing (c) and (d) (Table 41(c)). The *pleasing* aspects of environmental hazard and planning decisions scored 75 responses, distributed as employment (31), cleanliness (14) and education (6) (Table 41(c)). Twenty-four responses in different categories of  $< 4$  were regarded as insignificant and discarded. The *unpleasing* aspects scored 134 responses, distributed as air pollution (29), land pollution (27), smoke (14), diseases (12), water pollution (7), dust (6), sewage (5) and earth trembling (4) (Table 41(c)). Thirty responses of different category of  $< 4$  were regarded as insignificant and discarded.

From the open-ended responses the community awareness is not based on the direct dissemination of information, but through personal observation and length of dwelling

within the area. Health concerns were of greatest interest, with a few identified projects initiated by the industry in the community. On average, the community dwellers are not happy with their surroundings due to the unpleasant aspects as stated. That said, the community dwellers are not in a position to alter their situation.

To add to the above personal experiences in the coal-mining community, an open-ended question was structured on *environmental research on hazards*. The question intended to verify whether the mining industry is initiating projects on hazard mitigation in the community. Question 5 (a) and (b) *required respondents to give two examples of projects on hazard mitigation/protection undertaken by a mining company*. A total of 542 respondents participated in the questionnaire response process. Responses are distributed as: ‘No (*not aware of any example*)’ (314), abstain (178), inappropriate response (wrong attempts) (49) and longer term (1) (Table 42(a)) (Annexure 5).

Question 6, simply confirmed *whether the initiated projects were long-term, medium-term or short-term*. A total of 271 respondents participated. Scores are allocated as: *abstain* (145), *short-term* (57), *medium-term* (35), *wrong attempts* (27), *long-term* (5) and ‘No’ (*I don’t know*) (2) (Figure 9, Table 42(a)) (Annexure 5). This open-ended question concurred with the responses to Question 5, with a larger portion of participants abstaining. It is the only open-ended question with ready-made (suggested) answers. Respondents were expected to randomly tick a box in response, as compared to the other open-ended questions where introspection was necessary. These abstentions warranted further probing to confirm the responses to ensure whether abstain means: “*I don’t know*”; “*non-existence*”, or “*indecision*”.

Responses obtained in Question 5 indicate that most of the community is unaware of hazard-mitigating projects. No respondents identified a hazard-mitigating project initiated in the community. Though a few respondents (Question 6) identified with medium- and long-term projects, it is doubtful whether such a project exists. If there is a project, it is questionable why only a few could identify the *duration* without being able to identify the *type* of project. In both Questions 5 and 6, the huge score of *no, inappropriate responses* and the number abstaining is an indication of unawareness and non-existence of any initiative on the part of the industry and the local government.

Further evidence was drawn from an open-ended question, structured to assess awareness about hazard management equipment. Question 6 required respondents to *name two examples of new equipment bought by a mining company* for hazard management. A



total of 522 respondents participated in the questionnaire process, with the following scores: inappropriate responses (273) and abstain (249). Random selected quotes proved that the most common responses were:

*We know nothing about the equipment*

*No new equipment exists*

*Umbrellas and caps*

*Make fires*

*Caterpillars*

*Electricity and water pipes*

*I don't know.*

The comments show that no-one from the community is able to name equipment intended for hazard management. It could be that there is no equipment intended for hazard management or for other reasons. These are strategic industrial decisions that are not known to the public. However, issues of project initiation and existing equipment are often the result of a strategic management decision. Therefore, a poor comment result is a clear indication that the community is not aware of any equipment and has never seen any.

To further confirm the baseline of community awareness on equipment for hazard management, an open-ended question was structured on monitoring and control systems for hazards. Question 3 required *two examples of hazardous activities monitored in the community*. A total of 476 respondents participated in the questionnaire process. Scores are distributed as: inappropriate response (260), abstain (183), pollution (13) water (6) and carbon (4), indicating no awareness. Ten responses of different category < 4 were discarded as insufficient (Table 44(c)).

Inappropriate responses and abstentions are indications that there are no monitoring processes taking place in the community. However, if some activities are being monitored by any responsible authority, the larger part of the community should have been aware. This implies any awareness of hazard monitoring is based on personal experience and not on formal communication channels.

#### **5.1.3.10 Voluntary comments on strategic environmental management decision/planning**

Selected voluntary comments are quoted to assess the community knowledge about specific industrial decisions that relate to environmental management. Though this section was initially designed to assess the mining companies, the municipal authority and other stakeholders excluding the community by default, only the community and municipality were assessed. The mining companies and other stakeholders in the area declined to participate. Refusal to participate was considered to be a negative and evasive attitude towards the research and the community. The quotations are given per heading.

#### **5.1.3.11 Environmental hazard and planning decisions**

Relating to specific managerial decisions, a 50-year-old teacher who has resided in the community for 20 years wrote:

*When it comes to health hazards caused by the mining industry, the mines do not even communicate with the people (natives). They extract coal and take it overseas. They do not have any social responsibility. They do not donate anything for the local community, coal is very expensive, electricity is very expensive and skin problems are rife here.*

A 49-year-old teacher who has resided in the community for 19 years agrees:

*People or companies that own mining areas cannot decide to open new mining industry next to townships or near residential areas. As a result our houses are losing values. The cemetery, especially the tombstone, gets damage [sic] every time due to the dolomite [sic] that they used for mining. We have eye problems because of dust from the coal mine. Otherwise we are facing a very dangerous life around mining areas. It is not a good place for us to live.*

Another teacher 52-year-old who has resided in the community for 52 years concurred:

*If these mining houses can educate the communities about the health hazards that are caused by pollution, then our areas can be a safe place to live in. We need more community projects as a “thank you” gesture from these mining houses so that our people can be developed and be skilled.*

An 18-year-old learner who has resided in the community for 18 years commented:

*They must reduce the number of mines and the air pollution; it affects people living near the mines.*

### 5.1.3.12 Environmental research on hazards

Concerning environmental research on hazards, a 32-year-old educator who has resided in the community for 25 years and who wished to remain anonymous, commented:

*Mining industries enjoy making money from the community's natural resources without bringing back to the communities. They forget their social responsibilities to the communities. They should educate people about environmental hazards.*

Another educator, a 47-year-old who has resided in the community for 47 years, concurred:

*eMalahleni is situated next to Witbank. The place is surrounded by mines and firms that are polluting the area. There is a TB hospital, I know not of any project that is being conducted by the above mentioned in my environment. One other contributory factor, most of the houses is roofed with asbestos [material] that is hazardous to the environment. No project is taking place about this, from the government side.*

A 17-year-old learner who has resided in the community for 17 years concluded with dissatisfaction:

*I'm not satisfy [sic] with the companies for not paying any attention to us because we are not informed about hazards in our communities and what makes me very angry is that most of my community members uses coal to warm their houses and the smoke comes through the atmosphere and harm our health. So I think the companies must make sure they visit each community.*

### 5.1.3.13 Equipment for hazard management

On equipment to manage mining hazards, a 40-year-old educator who has resided in the community for three years commented:

*We must be provided with the equipment necessary for the prevention of these hazards. One other thing we must be conversant with the equipment.*

Another educator, a 47-year-old who has resided in the community for 47 years agrees:

*The State is duty bound to inform and educate the communities about the hazard management.*

A 45-year-old lecturer who has resided in the community for 45 years concurred:

*Local municipality doesn't inform the community about hazardous health activity they conduct.*

A 17-year-old learner who has resided in the community for eight years concluded with dissatisfaction:

*These mines are near our houses, and when the dynamites blast it damages our properties so they must try to move or we move [away from] this place.*

#### **5.1.3.14 Monitoring and control systems on hazards**

As to monitoring and control systems on hazards, a 44-year-old educator, who has resided in the community for 20 years commented:

*We are living in a dirty, a highly polluted ecosystem. There are too many firms, mines and informal settlements.*

A 17-year-old learner who has resided in the community for 17 years added an unhappy remark:

*I'm not satisfied with the companies for not paying attention to what is going on in the community.*

Another learner of 18-years-old who has resided in the community for 18 years agrees:

*We have water pollution at our communities because the water that we drink is dirty sometimes. When you open a tap you will find that the water is brownish it is dirty and we drink because there is nothing we can do.*

This is further echoed by a 29-year-old learner educator who has resided in the community for seven years as:

*The companies must come up with a possible means of informing the communities about the risk and how to monitor and control hazardous activities.*

#### **5.1.3.15 Improve risk and awareness practices**

In improving risk awareness practices, a 17-year-old learner who has resided in the community for 17 years wrote:

*I'm interested to know more about risk and hazard management, because it will help me one day and I can teach others about this.*

A 29-year-old educator on training, who has resided in the community for nine years agrees:

*Companies must come up with the relevant information pertaining to risk and hazards so as to ensure the well-being of the community.*



An educator 41-year-old who has resided in the community for 20 years confirmed:

*It is my wish that everyone must be informed about mine risk and when there is hazard management in the community.*

Another educator, a 40-year-old who has resided in the community for three years, advised:

*The government must force these companies to improve risk and awareness practice to the affected communities.*

Some initiatives were made on risk awareness and improving practices via the community coal smoke (*Basa njengo Magogo*) project. Photographic evidence is provided in Chapter 6.

#### 5.1.4 *Environmental Legal Application and Compliance*

##### 5.1.4.1 Awareness issues on environmental legal application and compliance

The overall average score (1.90) on this sub-set of questions on **Environmental Legal Application and Compliance** (Annexure 7: Topic A), indicating a *neutral* response. Four questions (Questions A1, A2, A5 and A8) scored an average per question  $> 2.20$ , indicating *awareness*. Three questions (Questions A6, A9 and A10) scored an average per question  $> 1.80$ , indicating a *neutral* response. Five questions (Questions A3, A4, A7, A11 and A12) scored an average of  $< 1.80$ , indicating *unawareness*.

In a sub-set of twelve questions only Question A1 has the highest average score (2.23) (2.24 for the learners and 2.01 for the general population) with a significant difference of  $t = 3.28$ , indicating *awareness* of *environmental legislation in their community*.

The lowest average score (1.58) was for Question A4 (1.68 for the learners and 1.47 for the general population), indicating *unawareness* of *National Environmental Management Act compliance in their community*. This is an indication that though the learners are aware of environmental legal requirements, they are unaware of the National Environmental Management Act, its application and compliance by companies.

Further probing was necessary to determine community awareness on environmental application and compliance.



#### 5.1.4.2 Information received via education

To verify the *neutral* response on environmental legal application and compliance, one question (Annexure 7: Topic B) was structured to verify the influence of education in terms of information provision. The overall average score (1.76) for Question B1 (1.94 for the learners and 1.55 for the general population), indicating *unawareness* by the general population of being educated about environmental legislation relating to hazards.

Question B1 shows a significant difference ( $t = 3.07$ ) between the learners and the general population. This resulted in more probing.

#### 5.1.4.3 Information received via industry or local government

To further verify the *neutral* response, the next sub-set of questions (Annexure 7: Topic C) was structured to assess whether information was received from an industry and local government. The overall average score (1.56) indicates *unawareness*. There is no significant difference between the learners and the general population in this sub-set of eight questions. The low response per question is consistently  $< 1.80$ , indicating *unawareness*.

The highest average score 1.60 was for Question C4 (1.67 for the learners and 1.52 for the general population), indicating *unawareness* that *the municipality has informed their community about mining company Environment Conservation Act compliance*.

The lowest average score 1.50 was for Question C3 (1.53 for the learners and 1.47 for the general population), indicating *unawareness* that *a mining company has informed the community about Environment Conservation Act compliance*.

Conclusively, both the learners and the general population are *unaware* of receiving any information from an industry and local government relating to environmental legal application and compliance. One wonders what the result would have been had information been provided to either the learners or the community by either an industry and/or local government. Thus, more probing into information sources is necessary.

#### 5.1.4.4 Interest to acquire knowledge

Lack of awareness about information is often interpreted as “no information”. Therefore, there was a need to verify behavioural response if information was made available. This sub-set of questions (Annexure 7: Topic D) was structured to answer the above questions

relating to the low level of awareness about environmental legislation. The overall average score (2.69) shows a high *interest* to receive information if provided. In the set of five questions there is no significant difference between the learners and the general population, with scores consistently > 2.50.

The highest average score (2.78) was for Question D2 (2.86 for the learners and 2.69 for the general population), indicating a *high interest to know about mining company application of the National Environmental Management Act*.

The lowest average score (2.59) was for Question D4 (2.64 for the learners and 2.55 for the general population), indicating a *high interest to know the application or change in application of the Minerals Act*.

This is an indication that any information provided could have been met with a receptive audience. Therefore, lack of information was evident in that information was not provided to the community. More probing was done to assess other means of awareness.

#### **5.1.4.5 Communication link**

Further efforts were made to verify the low awareness on environmental legal application and compliance by assessing the existence of any communication channels between the community and the responsible authorities. Three questions (Annexure 7: Topic E) were designed in this sub-set to verify any communication relationship. The overall average score (1.74) shows *unawareness of the existence of any communication relationship between industry, the municipality and the community*. In this sub-set of three questions, the average score was < 1.80, implying *unawareness of any communication relationship*.

There was no significant difference between the learners and the general population in any of the questions, implying that there is no difference in the awareness level between the learners and the general population.

The highest average score (1.77) was for Question E1 (1.88 for the learners and 1.65 for the general population), indicating *unawareness by the general population of any link between mining company and community participation in environmental legislation*.

The lowest average score (1.69) was for Question E3 (1.78 for the learners and 1.58 for the general population), indicating *unawareness of a tripartite communication link between the community, mining companies and municipality on environmental regulation*.

Conclusively, there is no cooperation and communication relationship with the stakeholders. Corporate social responsibility<sup>13</sup>, a cornerstone of sustainable development, does not exist in this mining community. Thus, the concept of a sustainable mining community is still to be realised. Therefore, further probing was necessary.

#### **5.1.4.6 Collective efforts via legislation**

Further verification was tested by a sub-set of questions (Annexure 7: Topic F), to confirm that the *neutral* response resulted from a lack of participatory involvement in environmental legislation between the industry and the community. The overall average score (1.84) shows a *neutral* response, indicating partial participatory involvement on legal requirements. The values per question show that only two questions (Question F2 and F4) have scores > 2.20 indicating awareness. Four questions (Question F1, F3, F5 and F6) have scores < 1.80, indicating *unawareness*. There is no significant difference between the learners and the general population.

The highest average score (2.40) was for Question F4 (2.33 for the learners and 2.48 for the general population), indicating *awareness* that *there is a need for a collective effort on the Environment Conservation Act*.

The lowest average score (1.56) was for Question F1 (1.62 for the learners and 1.49 for the general population), indicating *unawareness* that *there has been a collective effort between the municipality, a mining company and the community on National Environmental Management Act compliance*. This is an indication that industry has failed to provide the community with information on environmental legislation. Further probing was conducted on the community's perception.

#### **5.1.4.7 Personal observation on legislation**

The last sub-set of questions (Annexure 7: Topic G) on environmental legal application and compliance was to evaluate personal observation and pre-knowledge of existing legislation by individuals within the community. Two questions were structured in this

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<sup>13</sup> A meaningful relationship between the mining industry and nearby communities, in which development was to be the outcome. The WSSD coined this term not only for the mining industry but for all industries to exercise responsible behaviour towards nearby communities in some form of investment. This was to enable the existence of sustainable communities.

sub-section, with an overall average score of 1.71, indicating *unawareness*. This is an indication that the community had very limited pre-knowledge of existing legislation. There is no significant difference between the learners and the general population.

The highest average score (1.76) was for Question G2 (1.71 for the learners and 1.79 for the general population), indicating *unawareness* of a *mining company's compliance with the National Environmental Management Act*.

The lowest average score (1.67) was for Question G1 (1.82 for the learners and 1.49 for the general population), indicating *unawareness* of the *community's contribution to environmental legislation relating to hazards*.

This is an indication that information on hazards is absent, the observed knowledge acquired over the years of dwelling in the community is also absent. The community is *unaware* of basic developments from the mines in their proximity, including basic environmental rights. More evidence is drawn from open-ended questions, voluntary comments, individual interviews and a focus group discussion.

#### 5.1.4.8 Knowledge-based questionnaire response

Only one open-ended question was included within the batch of multiple-choice questions. This open-ended question seeks to assess community awareness and knowledge about existing environmental legislation. The question 8 (a) and (b) reads: *What environmental legislation is known to your community? Name two*. A total of 398 participants took part in the process, with 242 abstentions and 152 inappropriate responses (Figure 12 – Table 46).

Results show that inappropriate response and abstentions were the only two categories of response. No correct response was identified. Examples of inappropriate responses quoted from a random selection are:

*there are no laws I have heard of*

*harm-ness [sic] and sickness*

*no rubbish next to houses*

*water pollution, land pollution and air pollution.*

The high number of abstentions indicated the necessity to probe the detail of the community relations with the mining companies, the responsible authorities and the concept of environmental rights.

There seems to be a conceptual misunderstanding on the structure of the question. This was a measurement of community knowledge. In this batch of questions, the single open-ended question was the question most poorly responded to. Should one observe that the multiple-choice responses were *guess work* or abstaining means *I don't know*? By implication, the community dwellers are not aware of any environmental legislation, its application and compliance. This further explains the low awareness response on environmental legislation and compliance in the multiple-choice questions.

It is not surprising that the community is unaware of any environmental legislation, even though they live in an area covered with hazardous substances. They are also not aware of their environmental rights. No-one made a reference comment to Section 24 of the Constitution of the Republic of South Africa (RSA 1996c): 16 years after promulgation of the Constitution, people living in hazardous environment are not aware of their rights. This was further measured by the voluntary comments.

#### **5.1.4.9 Voluntary comments on environmental legal application and compliance**

Environmental laws are a very important tool in regulating humans and their activities (industries). Selected quotes are used to illustrate community knowledge about the environment with emphasis on environmental rights. Relevant quotes are placed per heading.

#### **5.1.4.10 Environmental legislation on hazards**

In a general understanding on hazards and legislation, an 18-year-old learner who has resided in the community for 18 years wrote:

*Community must be informed of environmental legislation on hazards.*

A 36-year-old educator who has resided in the community for six years, who wishes to remain anonymous, agrees:

*There was never a workshop on any environmental legislation in my community.*

Another educator, a 37-year-old who has resided in the community for seven years, confirmed:

*Since I'm a new resident in eMalahleni, I'm not sure if the mines relate with communities. However, I think I would have known if they (mines) ever teach the communities about anything. Capitalism is a disease. The mines want money, more money and nothing but money. Caring about people, I don't expect them. People here are illiterate squatters; they [could not] care less about their health or information.*

Another educator a 40-year-old who has resided in the community for three years confirmed:

*Failure to make us aware of environmental legislation and hazards is detrimental to our health. It is advisable for them to make us aware so we can fight back companies through laws. The legislature is ignorant and needs to bring the community into the equation so that everyone in the community can act and behave in a responsible manner.*

#### **5.1.4.11 National Environmental Management Act, Act No 107 of 1998**

As far as environmental legislation in South Africa is concerned, the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998) is the overriding legislation. It is obvious that the community should be aware of this legislation and industry needs to implement the legislation as required. An 18-year-old learner who has resided in the community for 18 years, who wished to remain anonymous, wrote:

*I would love to know more about the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998) for the sake of the health in our environment, whether we are living in a good healthy environment or not and if there are any hazards how can we live? What can we do to prevent threats because they cause a lot of illness and as a result many people die?*

A 48-year-old mine worker who has resided in the community for 23 years confirmed:

*In Greenside [mining site] we know the EMS (Environmental Management Systems) which lead to the International Standards Organisation (ISO) certificate only, not the National Environmental Management Act (RSA 1998).*

A 17-year-old learner who has resided in the community for 17 years commented in a rather unfriendly remark:

*They must close the mine or take the communities to somewhere else where there is no pollution and the communities must stop buying coal stoves, they must use electricity as a source of energy.*

#### **5.1.4.12 Environment Conservation Act, Act No. 73 of 1989**

Conservation is as old as human existence, using traditional and modern methods. The Environment Conservation Act is perceived as one of South Africa's oldest legislations on the environment. It is expected that the community should know about this Act. To assess community awareness about this Act, a 48-year-old mine worker who has resided in the community for 23 years, noted:

*We don't know what it is about conservation. We only know the EMS (Environmental Management Systems).*

To concur with the above, an 18-year-old learner who has resided in the community for 18 years commented:

*I want to know more about the Environment Conservation Act because I really want to keep my community safer [sic].*

Another learner, a 17-year-old who has resided in the community for 17 years, opined:

*I will be pleased to know more about Environment Conservation Act because it is important for us to know the state of the environment we live in.*

#### **5.1.4.13 Minerals Act, Act No. 50 of 1991**

The Minerals Act has been applicable to the mining community for quite some time as it was within the aegis of this Act that most mining companies were operating in these communities. It is expected that the community should have even an idea of its presence and execution. In assessing the community, a 17-year-old learner who has resided in the community for 17 years wrote briefly:

*I would like to know more about Minerals Act.*

Another 17-year-old learner who has resided in the community for 17 years wrote:

*Why don't they do medication?... I mean a special medication because more people are getting sick from these mines and now I'm using glasses because I have been infected by the mines.*

A 31-year-old electrician who has resided in the community for 15 years confirmed:

*The companies that are causing air pollution don't care about us so they must pay for the sick persons who are affected at the hospital.*

A 50-year-old manager who has resided in the community for 25 years suggested:



*Most people use coal to make fire, but they don't know about the hazards of coal.*

A 42-year-old general worker who has resided in the community for 22 years concluded:

*The mining company has to inform us on the application of the Minerals Act.*

#### **5.1.4.14 Mineral and Petroleum Resources Development Act, Act No. 28 of 2002**

The Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002) is relatively a new legislation to make its way into companies and communities. However, it is the only mining legislation in South Africa which makes specific reference to historically disadvantaged communities. Therefore, in 2010, some eight years after its promulgation, one would expect a community to know about the section of the Act that concerns them and how the community's environmental rights are enshrined. In assessing the community's knowledge, a 40-year-old mine operator who has resided in the community for 26 years, who wishes to remain anonymous, comments:

*I've never heard about this Mineral and Petroleum Resources Development Act, it's my first time, but I'm interested to know more and better about the Minerals and Mineral and Petroleum Resources Development Act.*

Another mine worker, 43-year-old who has resided in the community for 43 years – confirmed:

*We need to be informed about this minerals changes [sic] so that we can protect our environment and so on.*

A 39-year-old unemployed person who has resided in the community for 14 years stated:

*As part of community, we need to be educated about our environmental hazards, so that we could be safe.*

A 17-year-old learner who has resided in the community for 17 years advised:

*These mines are polluting our environment. People who live near Ferrobank [a metal smelter] are infected with TB and, if a mine closes, they live [leave] the mines unclosed. This neglect makes potholes and people die from them especially at Coronation settlements. There should be a day called Mine and Factory Free Day, where both mines and factories don't operate.*



## 5.2 Results of Individual Interviews

Individual interviews were conducted on three targeted members of the community and three outsiders. “Targeted members of the community” refer to members who live permanently in the community whilst “outsiders” are those who are not resident in the community but work in the municipality or for other institutions within the environs.

### 5.2.1 *Members of the Community Interviewed*

The Councillor of Ward 9 was among the members of the community who were interviewed. The process started when the Councillor was asked whether he was aware of a caravan stationed in his ward, the purpose of the caravan and why he was not present on the day of the caravan’s installation and inauguration. The Councillor answered:

*I wasn’t present on that day*

but acknowledged awareness of the purpose of the caravan

*...to teach the community a new technique of coal burning and to control smoke concentration in the community.*

When asked his opinion on this new initiative, he was certain and replied:

*It is a good idea. It sounds good. I think there is need for such a project. There is lot of smoke in the area, especially in the evening. The smoke makes us sick and anything can happen once you are sick.*

When asked about other environmental problems within his ward, the Councillor replied:

*There are lots of things not going right, but the community is poor and there is nothing that can be done. Look up there...*

He pointed out

*There is fire burning for years [spontaneous combustion], people [researchers] come here. We showed them... they wrote, but don’t come back. Dust is everywhere, places are dry and the wind blows the dust to our feet and homes. There is rubbish dumped everywhere [poor hygiene].*

The Councillor learnt that the project initiators are Anglo Coal (through talking to the Co-ordinator of the *Basa njengo Magogo* project), as it happens that the project was rolled over in his ward. The researcher advised Councillor that those problems are known as ‘hazards’. Thereafter the researcher asked the Councillor how he (in his capacity as Councillor) could assist to resolve the problems in his area. The Councillor replied:



*I don't know... you people should help. This is my first term as Councillor, and I know the municipality is poor.*

The next member of the community interviewed was the Marketing Director of a small private enterprise who was contracted to coordinate the *Basa njengo Magogo* project. She was the recipient of a 2007 Nedbank Capital Green Mining Award. She was asked the purpose of the *Basa njengo Magogo* project and what makes it special from past practices of coal burning. She replied:

*The purpose of this project is to initiate a proper way of coal burning in communities to reduce the concentration of smoke. Its originality is the burning technique, which is top-to-bottom burning, as opposed to the traditional bottom-to-top burning. It has the following advantages: it produced less smoke and gets hot faster.*

She was further asked the duration of the project, its stakeholders and why companies are initiating the project. She replied:

*The project is to last for three months, but can be extended. The major stakeholders are Anglo Coal, Sasol and other research institutions. This project was initiated as part of industry's environmental initiatives [corporate social responsibility]. Such a project is good if practised regularly to reduce smoke in homes, and this smoke is dangerous to health due to its content.*

She further responded to a general question that requested besides the smoke as an environmental problem in the community, were there other environmental problems to be concerned about? She replied:

*I don't really know. I'm not an environmental officer. I'm a marketing consultant. However, there are issues of dust and general sanitation that I can see, as the project proceeds.*

The next member of the community interviewed was a 60-year-old community elder who had lived in the community for more than 27 years prior to being interviewed. This woman was a community representative and a participant in the *Basa njengo Magogo* project. She had broad and extensive knowledge about the community. She was asked about the purpose of the *Basa njengo Magogo* project and whether the project made a change in her life. She replied:

*The project made some early changes to me and more will follow once people get to know of this project and its implementation. It will reduce smoke during coal burning and conclusively smoke in the community. Though I don't cook with coal, I sometimes braai<sup>14</sup>, it is generally a good initiative.*

When asked about other environmental problems encountered during her many years of residence in the community, she replied:

*In my community...extension 14... I don't see much to be done, but there is always a cloud of smoke from the Highveld metal industry, which I can see daily. However, in areas like Vosman, there is dust everywhere and there are underground fires. This area also doesn't have good toilet systems and drinking water. The running water is not safe to drink due to dumping of waste. The Basa njengo Magogo process exposed us to most of the problems including dust and general hygiene.*

In probing other sources of awareness – such as information received from the industry and municipality – and whether she knew about environmental laws, her environmental rights and, of concern, whether the attention of the mining company and the municipality had been drawn to the above problems, she replied:

*Neither the [mining] company nor the municipality ever informed us [community] ...it will be of interest to call the attention of the municipal office, though I don't know about environmental laws and environmental rights. Somebody like me cannot take the matter forward as nobody will listen to me.*

From the interview, it is certain that community dwellers are aware of possible hazards such as dust, poor sanitation, a lack of potable water (in Vosman Township), littering and other matters.

All three interviewees agreed on the above problems and acknowledged the *Basa njengo Magogo* project as a good mitigation to reduce smoke in the community. They all agreed that there is a problem of environmental concern in the community, and that awareness was created by the *Basa njengo Magogo* project and not by any other channel of communication such as an industry, municipality or other responsible authority.

The least aware interviewee was the Ward 9 Councillor, who was absent on the day the air-quality monitoring caravan was inaugurated. Though the caravan was installed in

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<sup>14</sup> Afrikaans word to “roast”, mostly referring to meat cooked over an open fire. It is common parlance in South Africa.

his jurisdiction, he was not properly aware of the purpose or function of the caravan. Even though he had received briefing from the Coordinator of the *Basa njengo Magogo* project, he confused the function of the caravan and the *Basa njengo Magogo* project.

### 5.2.2 *Outsiders Interviewed*

The Mayor (eMalahlani Municipality) was among the outsiders interviewed. The Mayor was asked whether the municipality has an environmental programme; whether environmental practitioners are invited to participate in their programmes, and about the relationship between the municipality and mining companies, based on the understanding that the coal-mining and coal-processing are the main economic activities supporting the community. The Mayor replied confidently:

*There is an environmental committee, and private environmental consultants are invited.*

She made reference to the researcher himself as welcome evidence. She went further to explain that:

*Our environmental committee works side-by-side with environmental officers/-researchers and there is a cordial relationship between mining houses and community.*

She was asked whether the community is aware of their environmental rights; how the municipality implements these environmental rights, and about the concept of corporate social responsibility. She replied:

*The municipality is aware of environmental laws, though other authorities like the Minerals and Energy, and Environmental Affairs and Tourism are more concerned with the enforcement and implementation of environmental requirements. The municipality is to execute services to the community. Corporate social responsibility exists as an integrated term. We exercise corporate social responsibility in providing basic services to communities, like drinking water, educational facilities, health facilities and other recreations.*

Probing more deeply into the submission of environmental reports by mining companies, the Mayor was asked whether companies and the municipality have informed communities about prevailing hazards associated with coal and whether the municipality has a programme encouraging mining companies to create social development programmes in the community. The Mayor responded selectively:



*We are not directly responsible for environmental reports. The Minerals and Energy Department is accountable. There are programmes on environmental health and sanitation. The municipality is behind projects like research, the Basa njengo Magogo Project and others.*

Her responses were mostly brief and demonstrated little insight.

The next interviewee was the Speaker of the municipality. The Speaker was the only interviewee who was interviewed twice (on 28 June 2006 and on 5 May 2007). The first interview was a 10-minute process on the inauguration day of the air-quality monitoring caravan and the *Basa njengo Magogo* project in Vosman Township. The interview took place on 28 June 2006, when the Speaker was representing the Municipality in the most senior capacity. During the course of conversation, the Speaker was approached and several questions were asked. They were not semi-structured questions but topical questions that arose from the occasion during the course of conversation. The Speaker was asked – as a senior representative – to detail industry’s efforts relating to the air-monitoring process, the cost of erecting the structure and whether that constituted corporate social responsibility? He replied by examining the cost first:

*It should amount to millions of Rand value. The project is a good initiative, though expensive. It shows that the municipality is not lying down and needs to get company involved with community. It is part of corporate social responsibility and we are trying to get company and community together.*

The Speaker was asked to look at the surroundings where the air-monitoring caravan was installed, and whether the area needed a (garbage) skip bin and why the municipality is not able to provide a skip bin in that area? He observed and replied:

*The surrounding is not very good, but this was the only best space for this caravan. The community needs a skip bin, but they cannot afford to pay for one if provided.*

When asked as a follow on from the previous response: “So this community should live or die in such a filthy environment because they cannot afford a skip bin?” the Speaker could not provide an effective response. He then replied:

*That’s not what I meant. Please excuse me.*

He walked away, thus ending the conversational interview on a hostile note.

The second interview took place during the afternoon of 05 May 2007 in the Speaker’s office after he had chaired the focus group discussion. The interview started at

about 15:30 and lasted for about 30 minutes. It was a brief, but focused interview. It started as a continuation of the focus group discussion, where the Speaker was reminded of the just-completed focus group discussion session, the type of questions posed and the environmental policy within the municipality. The Speaker was quick to respond:

*I was expecting such questions. What is happening is, most of the councillors who attended this session are serving their first term in office and are still to learn more on municipality policies. They don't know about prevailing environmental policies, they are still to learn. The municipality will teach them.*

He was further asked: “What is the municipality’s policy on environmental issues and the relationship between mining companies and the community?” He answered:

*The municipality oversees issues within its jurisdiction but there are other organs of State to be more concerned with the environment. The municipality consists of 62 councillors. They are divided into various committees and assigned specific duties. There is also an Environmental Committee. This places the municipality and mining company on a good trend, though mining companies are accountable to relevant [central Government] departments.*

The Speaker was asked to provide a previous environmental portfolio and how the municipality encourages corporate social responsibility within its jurisdiction. The Speaker responded:

*It is possible to see the portfolio, but not today, on a subsequent meeting. As regards corporate social responsibility, so far the mining houses are making some effort to encourage community development initiatives with other partners, including the municipality. The municipality per se has been more concerned on services delivery.*

Next the Speaker was asked: “Don’t you see that good service delivery can only take place in a good environment?” He was not happy with this question and refused to answer the question, becoming hostile once again. That became the last question for the session.

Conclusively, there were a number of shortfalls after interviewing the two most senior representatives of the municipality. Common points of convergence were the existence of corporate social responsibility and an environmental portfolio committee. Within these two points were divergences of understanding. Corporate social responsibility means different things to these municipal representatives. The environmental portfolio report mentioned above was never provided to the researcher despite numerous requests. The Mayor acknowledged the existence of environmental laws but she could not confirm

whether the community was aware of the existence of environmental laws or whether they were aware of their environmental rights.

The Speaker attributes the poor turnover of ward Councillors and upset of proceedings during the focus group discussion to lack of awareness, and a failure of the municipality to educate the councillors. He claimed the councillors were in their first term in office and still had to familiarise themselves with municipal policies on the environment and community development. This was not convincing, as a typed communiqué explained the proceedings clearly. Again, during the commencement of the focus group discussion, the Speaker iterated the purpose of the session. Though the duration of tenure of these councillors serving a first term in office was not probed, it was hard to accept that 20 ward councillors were serving a first term in office in one municipality without any pre-knowledge of municipal policies.

Another setback to these high-profile municipal officers was their evasive and defensive attitudes. Neither the Mayor nor the Speaker was willing to provide a direct response to a question. The Mayor was brief in most of her responses, avoiding the critical aspects of the questions. Evidence is drawn from her response on the awareness of environmental laws and its implementation in communities. She accepted municipal awareness of environmental laws, but avoided the community aspect of the question. She was quick to identify responsible authorities for the implementation and enforcement of environmental rights, excluding the municipality. The Speaker was evasive during the focus group discussion and personal interviews. He was quick to draw a conclusion. For example, the Speaker quickly acknowledged the existence of an environmental committee portfolio that was never seen. He was quick to terminate the focus group discussion on the grounds that all the attendees were serving a first term in office. He promised another session with full attendance that never materialised despite many telephonic and email requests and reminders.

During our discussion, the Project Officer was asked to estimate the cost of the project and to evaluate the installation site of the caravan. She replied:

*I initiated this project and it is a very costly project. There are other partners to the project such as Sasol, Anglo Coal and in partnership with Universities. As for the caravan installation site, it is not good. However, it is the most ideal site for the installation of the caravan.*

She was asked whether Anglo Coal has a corporate social responsibility policy, which projects they are involved in as part of their corporate social responsibility, and the duration of such projects. She was brief:

*Anglo as a whole is involved in corporate social responsibility and initiates programmes like HIV/Aids, air-quality monitoring and others. This project of air-quality monitoring is just one of many corporate responsibility projects to come. Though, I am not sure when this project will actually stop, but I predict a lasting project.*

Her attention was called elsewhere which brought the interview to a halt.

Judging by the various responses from the senior municipal representatives and the Anglo Coal Environmental Project Officer, there is little coherence. Each party acknowledged involvement in corporate social responsibility, with the project officer alluding to air-quality monitoring and HIV/Aids as existing examples. There was no insight as to how monitoring the air-quality would benefit the community. Worst of all was the HIV/Aids campaign within the community: there was no indication of treatment after HIV/Aids tests had been conducted neither was there follow up on the health outcomes of those testing positive.

The installation site of the caravan was not a hygienically appropriate location, as confirmed by the interviewees, but nothing was done to relocate it. The costly caravan project installation defeated its end purpose (good environment = good air). The fact that the mining company did not report directly to the local municipality is another setback to community relationship.

### **5.3 Results of the Focus Group Discussion**

An afternoon focus group discussion was held with the ward councillors of the eMalahleni Municipality. The session was chaired by the Speaker who was the most senior municipal representative present. Absent among the rank of senior representatives were the Mayor, the Secretary and the Public Relations Officer, who had all been informed of the session telephonically and in writing and they had all indicated (telephonically and in writing) their willingness to participate. The intention of the focus group discussion was to have a common debate of opinion on environmental problems, some identified by community dwellers (such as dust, sanitation and littering), and those unidentified (such as gases, air-quality and spontaneous combustion) and mitigations for these problems.



Twenty (20) of 42 ward councillors were present excluding the Speaker as the only non-ward councillor. The agenda of the session – which consisted of a short presentation on the research focus, followed by questions and answers – was communicated to all attendees in a communiqué attached to the invitation circulated by the Public Relations Officer. The session took place in the municipal hall. The session started at about 14:00 and lasted until 15:20. The session started with the Speaker introducing the guest speaker (researcher), by name, academic qualification and the purpose of the session (research focus). The Speaker reminded the attendees about the content of the communiqué and how the session would proceed.

The guest speaker had the floor for a 25-minute presentation. There were no slide shows as the municipality failed to provide a laptop and a projector as promised. After the brief presentation, there was enthusiasm to drive the debate. However, the session did not proceed as was planned and communicated to the audience. Instead of the researcher being permitted to pose questions to the attendees, the ward councillors posed questions to the researcher about the situation within the municipality and the community. As an outsider to the community, the researcher was not in a position to respond to any questions. Only the Speaker was able to answer the questions asked. This upset defeated the intention of the session. Individual names were not cited; rather the councillors were identified as Councillor 1, Councillor 2, Councillor 3 and Councillor 4. Here are some of the questions the councillors posed to the researcher:

Councillor 1:

*You have mentioned hazards and you are talking about coal hazards. What are you referring to? Not everyone knows what a hazard is. In your presentation you mention hazards repeatedly and the community. I wish to say today is my first time to hear about hazards. I don't know that you people from the bigger (city) area of learning considered us here as anything meaningful. If not see, look at the communities that we live in. Everything is poor, the houses are poor, unemployment common, and everything is dirty. Compare this to where you live in Johannesburg. Can you explain why?*

These questions were followed the audience shaking their heads, and mumbling:

*Yes, we did not get your definition of hazards.*

A definitive explanation of hazard was again given to the people. It seems the explanation given was not satisfactory as it did not cover all the sectors.

This warranted Councillor 2 to iterate along the same line of questioning:

*I want to know, as Councillor 1 said. Look at the community. Look at the houses. Look at the road system and other conditions that you know. Why? Why are you people living well in the cities and we in this communities are suffering? This is where the money comes from. But look. Can you explain why senior management doesn't stay in this area? They only drive big cars. They don't step their legs down to talk to us. Can you explain?*

The nature of the questions was tough and challenging. The researcher was not in a position to answer these questions. These were the type of questions to which the researcher wished to obtain answers from the councillors. When the researcher could not provide a reasonable answer, the Speaker intervened.

Councillor 3 wanted clarification on who the researcher was. Someone chipped in:

*He says he is from the University...*

He continued by making the following remark:

*I'm asking these questions for various reasons. You see, this mine officers and lawyers come here only when they want something from us. They don't like us, they don't care about us and they don't want to improve our lives. I have heard of a story about mine officers. When they want to evict us, because there are minerals for their good, then, they invite a meeting; prepare nice stories to tell us, so we can take to the communities. I hope you are not one of them...*

This was a fair question that needed no explanation, just a simple response:

*I am not one of them.*

A Councillor 4 was more explanatory than questioning. He had this to say:

*Look officer [researcher] we don't know what a "hazard" is. We have not been told or educated. We don't know more about the environment. The municipality has not given us issues about the environment. The mining companies have not informed or educated us on mining and environment.*

There was no answer to the above and this was followed by the next Councillor who was also more explanatory than questioning. He remarked:

*I hope you are the voice of the community. If you cannot explain to me, then take this to your school (institution), where you come from. Talk to the seniors that we are in hell. It is extremely hot during summer, cold during winter and the housing conditions are poor. Many other things may happen due to these conditions. We (our children) are often very sick and there is no money to help. During elections, the politicians will come with big cars and make promises which are never fulfilled. After elections they are gone for good. Mining officers don't come here to explain anything to us. We can see their machines at work over the hills. We can see dust sometimes high in the air. We don't know how these dusts affect us. There is also dust blown into our houses. There are cracks in the houses. We don't know the causes and there is no-one to talk to. There are laws as I learned but I don't know the laws and how it can be used.*

With such a comment, it is certain there is a problem and that ignorance is bedevilling the community. There was no possible answer beside:

*I have taken note of your concerns. I will put these on paper for the attention of my institution.*

The next Councillor wanted to find out from the researcher:

*Are you people allowed to participate with mining companies? Do they tell you people what they want to do? I'm asking this because I have lived in this community all my life. There has not been a formal gathering between the community and the industry. There is also no formal gathering between the community and municipality to carefully look into the impact of mining. I think, there is no participation with the community on mining issues. I know they employ our brothers and sisters. But we are still the ones to suffer more. I thank you.*

This was a good observation from this participant. Neither the researcher nor the Speaker was able to disprove the observation. The researcher could only remark that this was a good observation from someone who has lived in the area for his entire life. As for the Speaker, there was no response, as he acknowledged the next Councillor without being able to assert that there has been a gathering between industry, municipality and the community or that the community had been informed or educated about mining hazards.

The next Councillor did not have a remark but a straight-forward question:

*According to you, who knows a little better than us, what is the industry's decision on mining hazards?*

The Speaker did not provide an answer, but allowed the next Councillor to speak. This Councillor wanted to know more about hazards and the law. He put forward a series of questions:

*Are there laws that deal with hazards? And, if there are, how can we apply them in the communities? To whom are we to apply? Who will listen to us? I'm saying this because the companies are located far up there. They may claim they don't cause any harm to us. And they have money to support themselves against the law. At the same time metal industries are producing smoke. All of these make us sick. So how do we get legal recourse to stop them?*

This was an insightful question that was avoided by the Speaker and researcher. No answer was provided. There were many hands up eager to pose a question or a remark, but the Speaker intentionally called off the session on the pretext that the Councillors are not well informed about the process. He therefore announced a second session prior to which the Councillors would be formally instructed on what to expect. He further assured the attendees that the next session would be a full house as most of the absentee Councillors gave the excuse of short notice as the reason for their non-attendance. The Speaker said that the second session would take place a fortnight later.

In this regard, most of the questions that were intended for the Councillors were not asked. The session showed that the Councillors are unaware of what might be taking place within the municipality relating to mining and the environment. It was anticipated that most of the unanswered questions would be dealt with at the second session. It was expected that the second session would be fully attended by most and more experienced Councillors. It was a promised opportunity to present previously unasked questions and a better organised focused group debate. To the researcher, it was a good opportunity to restructure his questions and ideas.

The second session never took place, though a date was fixed in the previous dissolved session. The Speaker could not give any substantial reason for the failed second session irrespective of many telephonic calls and email reminders. More than one attempt was made to reschedule the second session but all attempts failed. The Speaker claimed he was too busy with other internal matters and had no spare time for a focus group discussion. More than one attempt was made to schedule an appointment with the Mayor to pursue the focus group discussion. The Mayor parried each telephone call and made herself quite clear on the subject:



*Please, the Speaker and the Public Relations Officer are the responsible authorities to handle your matter, not me.*

None of the above responsible authorities was willing to reschedule an appointment on this subject. They were also unwilling to discuss the matter telephonically.

This chapter provided information from the analysed multiple-choice and open-ended data, voluntary comments, individual interviews and the focus group discussion. The next chapter (Conclusions and Recommendations) contains an outline of the successes and failures of the WSSD/JPOI in terms of the research findings and details measures necessary for promotion of sustainable mining practice in communities.

## **5.4 Conclusion**

Chapter five assimilate the quantitative data from multiple-choice questionnaires, open-ended questionnaires, qualitative responses from voluntary comments, individual interviews and the focus group discussion into a facet. Multiple-choice questions per section were grouped per unit on common themes. For example, on health and safety, five units were grouped. All questions interrogating a common theme (awareness) were put together and the responses analysed (annexure 7). Further classification was done per question and respondents. Respondents initially classified between learners and the general adult population was further divided. The general adult population was divided into mine workers, general workers and the unemployed. The following values, t-test for variance and significant differences were calculated per theme to determine a common response. Awareness was given in averages per question. The overall level of awareness per section response was determine by the average score entire population, which is the sum of the averages per question. The level of awareness was further interrogated to determine the validity and sources of information. The highest and the lowest scores per section subsection and questions were discussed. Various sources of information were interrogated. Qualitative responses from open-ended questions, individual interviews and a focus group discussion were selectively integrated in the text in indented direct quotations, representing the community voice.

## **Chapter 6: INTERPRETATION AND DISCUSSION**

*This chapter draws together the research outcomes by summarising key features of the literature review (Chapter 2) (objectives i, ii and iii), and then interpreting the quantitative information presented in Chapter 4, the analysis of key results of the quantitative data, the analysis of interviews and the focus group discussion in Chapter 5 (objectives iv and v), leading to the final result (objective vi). This discussion is supported by additional evidence in the form of photographic images, personal observations and inferences.*

### **6.1 Key Features and Expectations Arising from the WSSD and JPOI**

This chapter interprets and discusses the research findings. The findings include data from multiple-choice questionnaires, open-ended questions, categorised voluntary comments, individual interviews, a focus group discussion and photographic images. Based on the contextual analysis of the outcomes of the WSSD (Chapter 2), it is expected that the hosting of WSSD in 2002 and the subsequent signing of the JPOI would lead to rapid implementation and transformation programmes by the South African mining industry. In accordance with the pledges and commitments that were made, such as the JPOI, written documents from the World Coal Institute, the United Nations Economic and Social Council (UNESCO) and the adoption of the South Africa Mining Charter, it could have been anticipated that these would contribute to changes in behaviour and action in terms of sustainability practices related to mining. In effect, these behavioural changes should have infiltrated mining industries, local government authorities and school curricula, to adopt new approaches and practice towards sustainable development. The WSSD, the JPOI and the subsequent South African Mining Charter opened a new chapter in South African mining history. Perhaps at a slower pace, knowledge of sustainability and climate change should be incorporated into the school curriculum as well.

During the WSSD deliberations and final signature pledges, the JPOI placed a strong social obligation on mining industries regarding community wellbeing known as corporate

social investment<sup>15</sup>. As the host nation of the WSSD, the then President of the Republic of South Africa (Thabo Mbeki) extended the mandate of Agenda 21 (*An Agenda for Sustainability in the 21<sup>st</sup> Century*) to include strong elements of poverty alleviation and social sustainability in mining communities. He urged the mining industry to maintain community sustainability during mining and to make adequate plans for post-mining socio-economic continuity. This created expectations, specifically that the South African mining industry would incorporate new actions in the social dimension, including communities that housed their workers and surrounded their mines. These expectations were placed under ethical responsibility and best practice guidelines.

#### 6.1.1 *Best Practice Guidelines*

The Department of Minerals and Energy incorporated the WSSD mining guidelines into South Africa's local legislation. This was done through the launching of specific mining programmes, such as Sustainable Development in Mining (SDM) 2004–2010, a programme intended to guide the mining industry to its highest contribution by the year 2010. This programme emphasised the commitment to good governance, improvement in health and safety, income and living conditions of the poor majority in which economic growth, greater equity, and self-reliance were to be achieved through sustainable use of natural resources. These strengthened and enforced social issues such as training, skill development, employment of women in mining and Black Economic Empowerment (BEE).

A clause within the WSSD guidelines requires regional and continental cooperation among mining industries and regulative bodies. These regional bodies were established and included the Chamber of Mines of South Africa, an internal organisation to participate with continental bodies. The Chamber of Mines of South Africa became a useful channel for mine management. At continental level, the Chamber of Mines of South Africa relates with

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<sup>15</sup> “Corporate Social Investment”, generally refers to the plough back of a portion of the company's profit into a close community for social development. This term was initiated during the WSSD as an obligation to mining industries specifically to invest in communities that provide labour to the mining industry. The term “corporate social responsibility” was used as a responsibility clause for mining industries to improve basic life conditions of their workers and nearby communities in which they operate.

international bodies such as the African Mining Partnership, and the New Economic Partnership for African Development to coordinate the mining activities.

By adopting the WSSD guidelines and being a member of African Mining Partnership and the New Economic Partnership for African Development, South Africa examined the adverse effects of mining and proposed a review of its mining activities in general. This was done through the creation of local initiatives and the assigning of tasks to specific bodies such as the Council for Scientific and Industrial Research and Mintek, both research institutions entrusted to carry out research on the current sustainable development constraints and possible solutions. CoalTech, a research institution, was entrusted with specific responsibilities and legislative requirements to appraise the WSSD/JPOI-approved guidelines. Other local initiatives were established such as mining standards, accountability, verification, quality assurance and certification in mining. In effect most of the local initiatives did little to improve local community wellbeing. Precisely on this researched community, best mining practices did almost nothing to upgrade community sustainability, therefore the ethical responsibilities of mining industries were reviewed.

### 6.1.2 *Ethical Responsibility*

International efforts were needed to address environmental legal and ethical responsibilities in the mining industry as outlined in the WSSD/JPOI documents. This was in line with South African domestic policies, legislation and marketing tools. During the WSSD/JPOI coal was prioritised as an energy source for sustainable development. Coal was identified as energy in need of cleaner technologies to become sustainable. This concept of a cleaner technology was ineffective due to inadequate means from home industries. As an ethical responsibility, the mining industry was expected to provide basic energy for community development. In the South African context, the mining industry did not provide meaningful recognition to this concept post WSSD. Visible evidence exists as some mining communities still exist without electricity and are in need of affordable energy for sustainable development. As an ethical responsibility to reduce indoor air pollution from coal burning, a national programme was launched known as *Basa njengo Magogo*. However, the effectiveness of the *Basa njengo Magogo* programme in reducing coal smoke from communities has not been measured at national level.



### 6.1.3 *Industries' Responses to the WSSD Guidelines Document*

In response to the WSSD guidelines document requirements, the Department of Minerals and Energy and the South African coal-mining industry adopted a comprehensive approach to the understanding of “sustainable development”. The mining industry responded in annual publications and accountabilities reporting, with emphasis on eco-marketing, consumption and disposal behaviours. The annual reports appealed to businesses and public institutions to encourage better disposal behaviour of by-products. Mining industries recounted their expenses and other activities with little on protection of the environment. Though visible evidence of corporate social responsibility was absent in the communities, companies made reference to a number of achievements to the Department of Minerals and Energy. It is doubtful whether reports submitted to the Department of Minerals and Energy reflected the reality of the community and industrial relations. Even when financial accounting reports are made public, they are limited to company cost and management statements as required by the Chamber of Mines of South Africa.

Evidence of failure is revealed in the misinterpretation of legislation in line with the WSSD/JPOI documents. This research revealed that the historical, social and economic consequences of mining are not addressed as required. For example, section 100 of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002) reads

In consultation with the Minister of Housing and Social Development to provide housing and living conditions standard for the minerals industry and develop a code of good practice for the minerals industry in the Republic...

This clause has not been enforced as the State and mining industries are evasive. Literature reviewed and quantitative data responses indicate that the community is not aware of the Mineral and Petroleum Resources Development Act (RSA 2002) and Section 100. This explains that the hosting of the WSSD has not changed behaviour and practice in mining communities in South Africa.

## 6.2 **Interpretation and Discussion of the Questionnaire Surveys**

Questionnaire surveys were the main source of quantitative information obtained in this research. Quantitative information was then manipulated to assess awareness, sources of information that created awareness if any, the provision of information to the community

by the mining industry and other industries. Information gathered from the questionnaires is interpreted and discussed below, by section heading.

### **6.2.1 *Discussion of Health and Safety Questionnaires***

The overall results using a t-test for variance shows a moderate awareness, which implies a partial awareness. Partial awareness on health and safety is an indication of poor communication. Evidence demonstrated that the level of awareness was not related to any form of educational knowledge derived through formal channels. There is evidence that schools and other channels of communication were not used to inform the community about health and safety. The findings show that the school curriculum has not changed perceptions among the learners and the general population.

The community researched showed an interest to receive information if it were provided. The community is interested to learn about coal hazards and health hazards emanating from coal. There was no information flow from the mining industry to local authorities and the community. To make matters worse, questionnaires conducted using the third-party approach revealed unawareness within mine workers and the general population. This was sufficient evidence of a poor inter-relationship between the mining industry and the community.

#### **6.2.1.1 Discussion of Health and Safety Open-ended Questions**

Community experience shows a low level of community awareness about health hazards. An open-ended question on coal-mining and coal-processing gases provided the worst results. From a total of 586 responses obtained, not one respondent identified a pollutant gas. This indicates the level of community ignorance, though this area has been gazetted in the National Environment Management: Air Quality Act, Act No. 39 of 2004 (RSA 2004), as amended by the Department of Environmental Affairs and Tourism (DEAT 2007) as an air-quality priority zone. The above responses demonstrated the community's relationship with stakeholders. By implication, one would have expected that the local authority in one of its divisions (environmental department) or local industry would have created awareness. However, from the questionnaire responses and the open-ended questions, this aspect of the environment has not been conveyed by the local authority, and any information from industry has not reached the community appropriately. Further evidence

drawn from awareness response on hazards and health effects shows that community dwellers were able to identify some common respiratory diseases from which they had suffered. Their experiences were derived through personal experience and observed health effects on relatives, friends and neighbours.

#### **6.2.1.2 Discussion of Voluntary Comments on Health and Safety**

Voluntary comments qualified community and individual thoughts about the environment, mining operations and community health. Most of the comments indicate an understanding of common diseases within the community and they illustrate the unhappy state of the community. The comments indicate an attitude problem between the mining industry and the community relationship. The community blames the mining industry for not educating and informing the community on the side-effects of their operations. This is in line with the WSSD/JPOI requirements. Though the term “hazard” was not very familiar to the community, issues of dust exposure, noise and vibration, and effects of temperature were known. Respondents were aware of the effects of these hazards to health, though the extent of their knowledge was limited, based on the socio-economic circumstances of this community. The community was generally disgruntled by the failure of the mining industry to inform the community about the potential dangers of coal-mining and coal processing.

#### **6.2.2 Discussion of Disaster Preparedness and Awareness Response Questionnaires**

The manipulated data on the level of awareness using a t-test for variance shows a *neutral response* on the disaster preparedness and awareness response. This was evidence that the community is not aware of disaster-preparedness measures. Evidence proved that the neutral response corresponds with the lack of provision of information from the local government authority and the mining industry to the community. Though information is lacking, the community indicated an interest to receive information if provided. Therefore, no information was provided or information was inappropriately channelled. By using the third-party approach, the perception that mine workers were better aware of mine hazards was eroded. Though the community is aware of coal hazards, it is not aware of possible disaster-preparedness measures.

### **6.2.2.1 Discussion of Voluntary Comments on Disaster Preparedness and Awareness Response**

Comments obtained show that there was insufficient awareness of disaster-preparedness measures in the community. Most of the comments failed to clearly identify specific examples of initiatives executed by either the community or the mining industry. Though most of the comments identify hazards such as smoke, explosives and spontaneous combustion, no corrective measures were identified. Though all blame was levied on the mining industry for not protecting the community, nothing was mentioned about how the community was protecting itself.

### ***6.2.3 Discussion of Strategic Environmental Management Decisions/Planning Questionnaires***

Awareness on strategic environmental management decisions was *neutral*, which means partial awareness. This implies the awareness level was not based on information obtained through education. Therefore, educational channels were not used as sources to disseminate information. Further evidence also indicates that information was not obtained directly from a local authority or industry neither was it obtained through inter-communication relationships.

The level of awareness and the possible sources of information indicate a generally low cooperation between the community, the mining industry and the local authority, though community responses indicate an interest to receive information if provided. This interest to receive information was an indication that lack of information in the community is not a result of refusal to accept information, but as a consequence of the unavailability of information. The fact that the mining industry operating within the area refused to participate in this research illustrates that the mining industry has not been initiating development projects in the community. The unawareness is an indication of the community being dissatisfied. The disillusionment arises from the poor communication relationship between the responsible authorities and the community and failure to use educational institutions – such as schools – as potential channels of communication.

### **6.2.3.1 Discussion of Strategic Environmental Management Decisions/Planning Open-ended Questions**

Responses are a result of direct information through personal observation and length of residence in the community. Though health concerns were top of interest, there were no clearly identified projects initiated by the mining industry. Thus, community dwellers are not happy with their lot. No respondent was able to name any equipment intended for hazard management. The comments are a good indication that the community is not aware of any equipment and has not seen any, neither have they seen any equipment in action. Although an air-quality monitoring process and an indoor coal-burning project known as *Basa njengo Magogo* were launched in this community, inappropriate responses and abstained answers were indications that the purpose of the project was not well communicated to the community. This is due to the poor relationship that exists between the community, local government authority and mining industry. It further illustrates the failure to use appropriate channels of communication to conscientise the community.

### **6.2.3.2 Discussion of Voluntary Comments on Strategic Environmental Management Decisions/Planning**

Strategic environmental management was meant precisely for the assessment of company policies. The fact that the coal-mining industries operating within this community contrived not to participate in this research was an indication that something was wrong. Therefore, assessing the community was a technique to measure industrial and community relationships. Most comments did not reflect a better understanding of company managerial decisions. Though all comments laid the blame on the mining industries operating within the community, there were no examples of known company policy executed in the community. This was sufficient indication that the mining industry has no precise policy and plan for the community. This was seen during the inauguration of the air-quality monitoring caravan at the centre of Vosman Township to which community representatives were not invited. Not even the Ward 9 Councillor was present, though the caravan was installed not far from the councillor's house. The Speaker of the municipality was present – not as an active participant, but as an observer of a process occurring within his jurisdiction.

#### 6.2.4 *Discussion of Environmental Legal Application and Compliance Questionnaires*

Assessing the level of awareness indicates a *neutral* response, implying a partial awareness about some issues of environmental legal application and compliance. The level of awareness indicates that education has not contributed in any form of awareness. Further evidence illustrates that the local government authority and mining industries have not provided information to the community. Therefore, the learners and general population are not aware of any information from an industry or local government authority on environmental legal application and compliance.

Lack of awareness is interpreted as meaning no information has been provided. This is evident as the community indicates a high willingness and a strong interest to accept information if provided. Therefore, if any information had been provided, it would have met with a receptive audience. This is an indication of a poor communication relationship between the industry, the municipality and the community. Conclusively, the concept of corporate social responsibility did not exist in this mining community. Therefore, a pre-knowledge of community environmental rights is absent.

##### 6.2.4.1 Discussion of Environmental Legal Application and Compliance Open-ended Question

A single open-ended question to determine community pre-knowledge about environmental legal application and environmental rights provided two categories of response: inappropriate responses and abstains. The result proved that not one correct response was identified, and there was a high number of abstain. This was interpreted as a conceptual misunderstanding of community environmental rights. Therefore, the community is unaware of any environmental laws, or environmental rights, even though they live in a hazardous area. No-one made a reference to Section 24 of the Constitution of the Republic of South Africa (RSA 1996c). This explains why 16 years after the Constitution was promulgated, and more than five years after the hosting of the WSSD (in 2002), people are still living in hazardous environments unaware of their environmental rights.

#### **6.2.4.2 Discussion of Voluntary Comments on Environmental Legal Application and Compliance**

Respondents were pleased to know that legislation exists to protect them and their environment. They felt it was a privilege to learn about environmental legislation and environmental rights. This was evidence that most respondents were not aware of their environmental rights. These comments show a failed relationship exists between the community and the mining industry and the community blamed the mining industry for failing to educate the community. To a lesser extent the municipality was blamed, though the municipality has the capacity to use one of its committees (such as the Environmental Committee) to educate the community on their environmental rights. Conclusively, the executives of the South African mining industry have failed to uphold their pledges regarding the JPOI. They have not respected the pledges of JPOI, therefore, the hosting of the WSSD was meaningless to the South African mining industry.

### **6.3 Interpretation and Discussion of Individual Interviews**

Individual interviews gave an insight into this research. All those interviewed had a common view, which was the acknowledgement of the unhealthy state of the community. Most commonly, issues of litter, sanitation and smoke were identified. The *Basa njengo Magogo* project was well known to the interviewees, but none of them knew of its effectiveness. Only the Speaker and the Anglo Coal Environmental Project Officer, who were aware of the purpose of the air-quality monitoring process, knew how effective it was, but they understood the project differently. The Speaker saw it as a start to a company ploughing funds back into the community, the process of corporate social investment (corporate social responsibility). To the Project Officer, it was the beginning of a series of community and industrial relationships. The Ward Councillor was not aware of the purpose of the *Basa njengo Magogo* project or the air-quality monitoring project as he was not invited to the inauguration of the air-quality monitoring caravan. The Mayor did not provide a satisfactory response, but rather a series of inferences.

The Mayor (eMalahleni Municipality) and the Speaker made reference to a cooperation between the municipality and the community. They alluded to an environmental committee to enlighten the community on environmental affairs (environmental rights). No evidence was presented regarding previous projects of the environmental committee. The Mayor emphasised the limitation of the municipality

regarding environmental matters. She was clear: issues of environmental reporting were beyond her jurisdiction. The Departments of Environmental Affairs and Minerals and Energy were accountable. These departments declined to participate in this research, despite receiving several invitations to do so. This implies that major participants, like the Department of Minerals and Energy and the Department of Environmental Affairs and Tourism, the mining industries, the Mayor and the Speaker of the municipality and other stakeholders, are aware of existing environmental laws but are unwilling to use them appropriately. Informing and educating the community about their environmental rights is an example of interpreting and disseminating the law appropriately.

#### **6.4 Interpretation and Discussion of the Focus Group Discussion**

The focus group discussion provided an insight into the municipality activities relating to policy and service delivery in the community. It was expected that the Ward Councillors are well informed of the municipality plans of action including environmental decisions within the community. The session provided an unexpected result. The absence of the Mayor and the Public Relations Officer was interpreted as an indifferent response from the senior municipal authorities.

The focus group discussion was an embarrassment to the Councillors and the Speaker. The initial process as outlined regarding the agenda served to the Councillors prior to the session was reversed. The common reason was the fact that the Councillors all acknowledged the decayed state of the environment by outlining issues such as poor houses, bad roads, lack of sanitation, unavailability of drinking water and extreme poverty in the community. Although the term “hazard” was difficult for most Councillors to understand at first, once it was understood it triggered more questioning. The nature of the questions posed forced the Speaker to respond. From the questions posed, it is certain that little information circulates between the seniors and the subordinates in the municipality. Some of the attempted answers by the Speaker were not adequately responded to, implying even the Speaker was poorly informed. The session was prematurely adjourned, with the intention to convene a second session where all would be present. The second session never took place despite the many attempts to convene it (Section 5.3).

In a personal inter-discussion after the failed session, the Speaker advised that all of those who attended the session were in their first term in office. It was not possible to have a quorum of councillors all serving a first term in office. If that was an honest testimony,



then there is lack of information even within the ranks of the municipality. This was evidence of failure within the municipality, as good service delivery can only be effective in a satisfactory environment. Therefore, failure to enforce the environmental rights of a community is a sign of failure in service delivery and human rights. To illustrate the Councillors grievances about the state of the community, photographic images are included.

## **6.5 Supplementary Evidence from a Photographic Survey of Vosman Township and the Environs**

During the course of administering the questionnaires, photographs were taken during the fieldwork process. Any aspect of interest was photographed and a selection of relevant images has been integrated into this document and discussion. The images covered a range of aspects, from the general community outlook, environmental conditions, the structure of the houses, smoke generated from households and industries, spontaneous combustion, hazards that were not covered during the questionnaire processes, to interventions by the mining industry and local government.

### **6.5.1 *Community Sustainability: Environmental Overview***

Arguably, a sustainable community should not be subject to the conditions shown in the photographs. This is a general overview of the community and neighbourhood of Vosman Township. The photographic images (Figure 13) illustrate the peculiarities of this research area. The houses are not well structured and designed, rubbish and litter are scattered all over the place. The situation is worse during and after rains, with pools of stagnant water and flooded houses. The images illustrate: (a) a muddy street named after freedom icon Steve Biko; (b) a pile of uncollected garbage after a community clean-up attempt; (c) a section of Vosman Township flooded after a rain storm; (d) litter and solid waste scattered all over the area.

The next photograph (Figure 14) illustrates the double standards of Vosman Township and the neighbouring community. Houses are built using both modern and local (traditional) materials. The photographs illustrate: (a) a shopping centre built of modern sun-baked bricks; (b) typical township houses built with various materials, with evidence of stagnant water, domestic animals roaming uncontrolled; (c) Reconstruction and Development Programme houses built adjacent to shacks and (d) a long-distance view of the disorganised nature of community houses (shack dwellings).



Figure 13: The general environmental conditions in Vosman Township



Figure 14: The environmental double standards of the Vosman community

A careful look at the surroundings of the Vosman community (Figure 15), shows vast health hazards and an unpleasant community environment. Most of the area is covered with flood water after heavy rains. Uncontrolled disposal of household waste is a severe problem in this township. The figure illustrates: (a) a flooded community after a rainy day; (b) stretch of the community covered with litter; (c) a dwelling flooded with rain water, solid waste and litter, and (d) a pile of accumulated waste, indicating erratic waste collection services.



**Figure 15: Community is covered with solid waste, litter and flooded water**

Further evidence shows that solid waste and litter constitute a serious environmental problem in this community (Figure 16). The images illustrate: (a) a house surrounded by solid waste, litter and domestic animals (goats) scavenging for food and (b) sections of waste piles burnt by the community as an intervention mechanism in waste control.

The photographic images illustrate the general filthy environmental conditions of this community. The flooding caused by rainfall adds to the already unhealthy community environment that is covered with solid waste almost everywhere. This unhygienic environment, coupled with stagnant water, demonstrates the vulnerability of this



**Figure 16: Domestic animals scavenge litter for food and some community waste control interventions**

community to health hazards. The photographic evidence illustrates that most of the rubbish is not dumped far away from residential dwellings and the accumulated pile confirmed that dumping of litter and household waste has been a long-time practice. Domestic animals (in this instance, goats) scavenge through the rubbish for food (Figure 16(a)). These animals will, in turn, be slaughtered for food at a later stage. This does not only expose the hazards of poor waste disposal to human health but also to the domestic animals which will, in turn, be eaten by humans. Therefore, there is a cycle of exposure to human disposed waste in the environment which will be eaten by domestic animals and progress down the food chain to become food for humans.

The most visible community intervention to control solid-waste disposal has been deliberate burning of waste using fire as a control mechanism (Figure 16(b)). By using fire as a control intervention process, the community indicates an awareness of waste and litter; possible hazards associated with poor waste disposal and possible health effects. This is also an indication that the waste disposal service provided by the municipality (eMalahlani municipality), as part of its basic service delivery, excludes the Vosman community. This is also in line with an interview question posed to the Speaker, why this community does not have a waste skip bin, a basic requirement in all urban communities. The Speaker answered openly: *'there is need for a skip bin but this community is poor and cannot afford [one]'*. Further questions on waste management in this community and the absence of a skip bin were brushed aside.

With inputs drawn from questionnaires, voluntary comments, individual interviews, the focus group discussion and photographic images on the general environmental conditions and waste disposal in Vosman Township, it is indicative that the waste and litter issues in the community researched are well known to most of the community. Evidence of interventions from the industries and the municipality is absent. By implication, the outcomes from hosting the WSSD and the JPOI signature pledges by heads of state and the mining industry has not filtered down to this mining community. Further evidence of failure from the WSSD charter is seen in the structure of community houses.

### 6.5.2 *Housing Structure*

The environmental conditions and houses were regarded as prime indicators of well-being. Therefore, improvements in the environment and housing conditions were sustainable efforts to alleviate poverty in disadvantaged communities. The structure of the houses and their locations were key indicators of income level and living standards. Photographic images were taken to illustrate the general living conditions of lowly paid mine labourers. Although the government has intervened in new development projects, known as “Reconstruction and Development Programme” housing, it has created an uninformed housing pattern (Figure 14). Typical community-built houses are from waste material and corrugated metal that are often affected by chemical weathering.

The community of Vosman Township has diverse housing structures. The images indicate the typical housing structure in Vosman Township (Figure 17). The houses are built from various materials depending on availability and affordability. The figure illustrates: (a) disorderly houses built of corrugated iron sheets, randomly placed without definite lanes between the houses; (b) clusters of houses built from different materials; (c) houses built out of local mud, showing areas of collapsed walls and (d) a reflection of a paradox, within a section of the same community. A tarred road runs through the community; adjacent to the shacks are Reconstruction and Development Programme design houses with cellular telephone satellite poles and street lights. However, the problem of garbage removal remains an issue within both to the well-to-do and the less well-to-do community.



**Figure 17: Community houses and building materials**

Footpaths weave between individual dwelling shacks in the community (Figure 18). The footpaths are eroded during the rains and sometimes become filled with waste transported from the dump. The images illustrate: (a) a footpath used by community dwellers to access their dwellings. Evidence of collapsed dwellings is seen as a result of heavy rains; (b) a toilet surrounded by wrapped plastic close to a dwelling. Residents walking through these back yards are exposed to the users of the toilet and unhealthy smells due to poor sanitation.



**Figure 18: Eroded footpath leading to other dwellings affected by heavy rains**

This section illustrates that the houses in Vosman Township are built mostly of corrugated iron sheets. There are few proper windows for ventilation. The poor nature of the buildings exposes the dwellers to extreme weather conditions and seasonal fluctuations. During winter, indoor coal burning is common to heat the dwelling and, by so doing, generating a concentrated volume of indoor smoke. In summer, cooking of food and heating of water also generates indoor smoke from coal burning, coupled to the high daily ambient temperature. Images taken to illustrate the footpaths leading to houses further illustrate the seriousness of the problem. The photographs (Figure 18) illustrate that the footpaths are narrow, undefined, with rains eroding gullies. Whilst walking along the narrow footpaths, dwellers pass behind unfenced houses. Some of the sanitary systems are covered with plastic, making the area unsightly. This exposes the community to smells and bacteria emanating from human disposed waste and other domestic waste.

Little information has emanated from the mining industry regarding the health implications of indoor coal burning and unhygienic surroundings. Community dwellers are aware of some health effects or diseases associated with consistent exposure to coal smoke. However, their awareness is not based on scientific or medical reports from a reputable source. Respondents through questionnaires, voluntary comments and focus group discussions can make reference only to health effects on relatives and friends as source examples.

### 6.5.3 *Spontaneous Combustion and Unsafe Ground*

Less than 1.5 km from Vosman Township, lies an abandoned underground coal-mining area. The derelict mine site represents a hostile environment to the immediate community. There is a vast area of decaying vegetation, bare soil and it is unprotected from community trespassers. Photographic images illustrate (Figure 19) an area of previous underground coal-mining. The area is currently suffering from (spontaneous combustion) underground coal fires. This area is unprotected and community trespassing is rife. Signposts are erected without visible notices and barrier protection. The images illustrate: (a) an area of bare soil and decaying vegetation; (b) three engraved sign posts erected approximately two metres apart are confusing: the middle post indicates “no trespassing allowed”; two metres away to either side of this sign post, ‘safe routes’ are indicated (meaning it is safe to traverse the area); (c) cracks in the area indicating collapsed surfaces; and (d) crevices which have developed from the collapsed surface.



**Figure 19: Confusing indicators of “safe” and “unsafe” access ways into a spontaneous combustion site**

The derelict mining site (Figure 20) is characterised by sink holes, collapsed surfaces, smoke, loose and baked soil, underground fires, and the absence of vegetation. The



collapsed surfaces later served as potholes for stagnant water during the rainy period. The figure illustrates: (a) pools of stagnant water during the rainy season and stretches of decaying vegetation; (b) further stretches of decaying vegetation, crevices, collapsed surfaces and smoke from underground fires; (c) evidence of baked soil around a crevice and (d) a more developed vent with heat from underground fires.



**Figure 20: Bare surfaces, collapsed surfaces and crevices caused by spontaneous combustion**

The next set of photographs (Figure 21) illustrates that people and animals access and traverse this area for various reasons. The images show that those who accessed the area are researchers (to gather information), herders and cattle (for food) and pedestrians (for crossing between communities) (Figure 21). The figure illustrates: (a) a herdsman walking across a stretch of bare ground with two dogs, in search of food for his cattle; (b) herds of cattle strolling through the bare ground and nearby bush for food and drinking water; (c) two researchers accessing the spontaneous combustion grounds for research purposes and (d) a researcher standing on risky ground above caverns of spontaneous combustion, in an attempt to observe and recount the extent of the damaged area.

The photographs illustrate many issues including the vulnerability of the community through poor communication relationships and the unprotected area. Though this area is

sparingly vegetated, it is combed by various people: researchers for information and herdsmen and cattle for food. The footpath that crosses this risky ground leads to the next community. Therefore, this area is a daily access route used by community dwellers of the two communities. The mining industry and the local government authority have not prevented the community from accessing this dangerous area or provided a safe access route.



**Figure 21: Humans and animals accessing an abandoned mine site that shows evidence of spontaneous combustion**

#### 6.5.4 *Atmospheric and Ambient Air Quality of Vosman Township*

The next images (Figure 22) illustrate the atmospheric conditions of Vosman Township and its surroundings. These photographs were taken during the winter month of August 2007. The research period was chosen carefully as more coal burning takes place during winter months to provide warmth as diurnal temperatures are very low then and people need warmth from any source possible. Two sets of photographs were taken in the evening between 18:00 and 20:00 and in the morning between 06:00 and 07:00. The images illustrate: (a) a plume of smoke through the chimney of a house; (b) a concentration of

smoke from neighbouring houses, obscuring illumination from a street light; (c) an inversion layer of smoke in the morning over the community and (d) a plume of smoke from metal-smelting industries close to the township. The plume of industrial smoke is constant throughout the year.



**Figure 22: Atmospheric conditions in Vosman Township at night and in the morning**

The images illustrate an overcast atmosphere with smoke from both households and industries. The impact of a temperature inversion on this community can well be imagined. The constant plume of industrial smoke is indicative of unpleasant quality of air and is indicative of the quality of the air inhaled by the community. The implication is that community is not affected by only indoor smoke but also by smoke from surrounding industries.

### 6.5.5 *Water Pollution and Salinity*

A single stream runs through the community of Vosman Township. This stream is the main water source for household usage. The informal section of the community has no pipe-reticulated water; therefore, its residents depend on this stream for their water supply. This water is also not free of pollutants from waste disposal. Though drinking water can be

fetched elsewhere, this water source remains a vital source of water for daily household usage. This water flows throughout the year, with seasonal variations in volume (Figure 23). The images illustrate: (a) a foot bridge to access the stream during normal water flow, the water overflows the bridge during the rainy season; (b) an overflowing water bank with pedestrians and learners struggling to make access to school; (c) the proximity between the water source and the community and (d) a brownish flowing stream with dumped litter projecting above the water level.

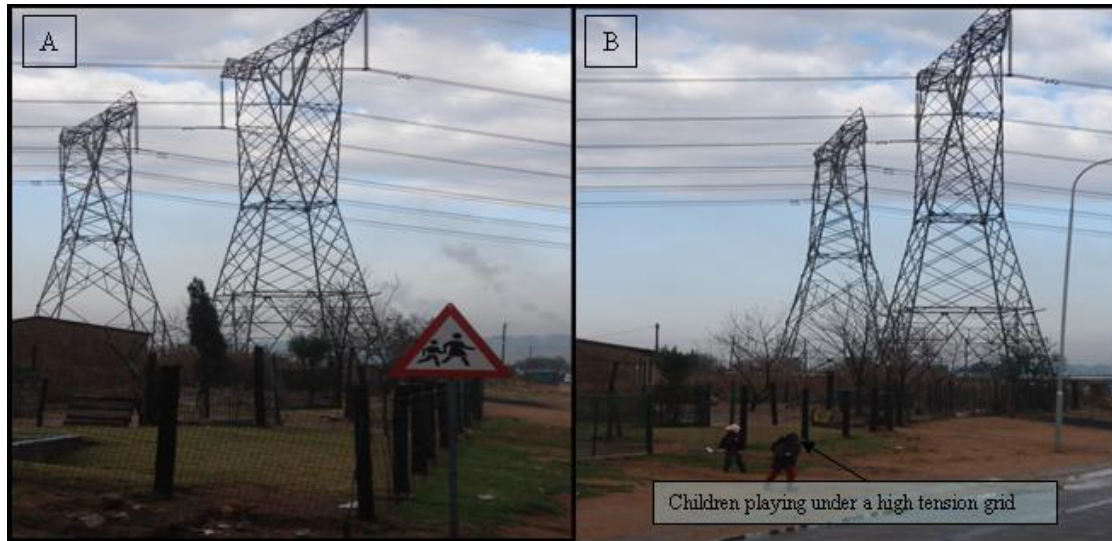


**Figure 23: A running stream behind Vosman Township and how it is crossed**

#### 6.5.6 *Other Hazards in the Community*

A high-tension electrical power line runs through the community of Vosman Township. Ironically this community is only partially electrified. The WSSD emphasises the need to electrify rural communities as part of poverty alleviation and sustainable development. It is well known that this is the province in which coal is extracted for the generation of thermal electricity and is, therefore, the province providing the source of most of South Africa's electricity, yet rural communities in this province are not electrified. Lack of electrical reticulation retards development. The impact of a high-tension wire over a community is a

hazard to that community. High-voltage electricity grid reticulation lines run across Vosman Township (Figure 24). The images represent: (a) two high-tension grid electricity lines, poles made of metal, and the poles fenced off for safety reasons; (b) two high-tension grid lines with children playing close to the power lines where the poles are not fenced off.



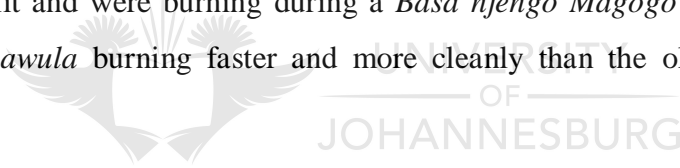
**Figure 24: High voltage lines as a hazard in the community**

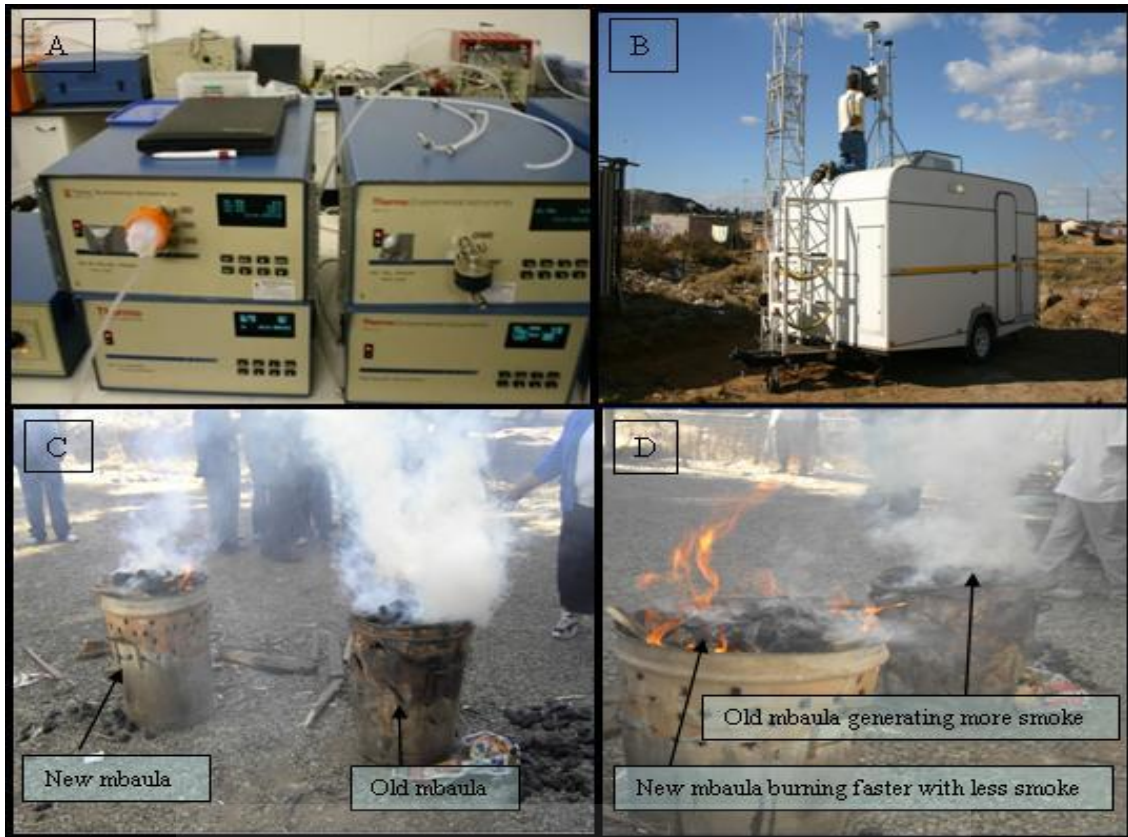
Electricity is one component that is essential to human development. Electricity is used in entertainment, communication, education, public health services, cooking and heating. Based on the need for electricity for sustainable development, the government of South Africa enacted the policy of *free basic energy* (electricity). Ironically, with high-tension grid lines stretching across this community and the purpose for which electricity is intended, this community still lacks basic free household energy.

It is questionable as to what extent the residents are responsible for their conditions. From 1994, the basic tenet of the liberated government was transformation. The WSSD also earmarked transformation. More than five years after the WSSD, in an industrial heartland (major coal industries, metallurgical industries, power stations and power lines) this community does not show any major signs of sustainable development. In response to the dilapidated state of the community, some intervention measures were attempted to give the community a facelift by the National government and collaboration of the mining industry.

### 6.5.7 *Interventions in the Community through Air-Quality Monitoring and Smoke-reduction Devices*

To assess the quality of the ambient air within Vosman Township, a consortium of mining industries (Anglo Coal and Sasol), the municipality and research institutions (the University of Witwatersrand and the University of Johannesburg), launched two intervention programmes: air-quality monitoring and the *Basa njengo Magogo* project in 2007. The air-quality programme was intended to monitor and analyse the ambient air quality, while the *Basa njengo Magogo* project was a community coal-burning demonstration programme to reduce coal smoke during indoor coal burning. The *Basa njengo Magogo* project was introduced through community demonstration, while air-quality analysers were installed in a caravan that was stationed at the centre of Vosman Township (Figure 25). The air-quality analyser was able to automatically analyse various components of the air and the results were stored in a computer memory box. The images illustrate: (a) a set of automatic analysers, as installed in the caravan; (b) the stationed caravan containing the analysers and an air vent on top; (c) two *mbawulas* filled with coal which had been lit and were burning during a *Basa njengo Magogo* demonstration, and (d) a modern *mbawula* burning faster and more cleanly than the old-style, home-made ones.





**Figure 25: Some interventions in the community (an air-quality monitoring device and a smoke-reduction process through improved coal-burning stoves)**

The scene of a *Basa njengo Magogo* project illustrating the burning process of the home-made and the modernised *mbawula* (Figure 26). The two *mbawulas* are placed side-by-side to compare the burning lag time. The figure illustrates: (a) a project coordinator explaining the value and importance of using the newly designed *mbawula* as opposed to the old-style, home-made one during a project demonstration; (b) a typical home-made *mbawula* emitting concentrated smoke.



**Figure 26: A demonstration and explanation of the *Basa njengo Magogo* process**

Though the mining industry declined to participate in this research process, they were interested to probe into the air-quality of Vosman Township. This is an indication that something is amiss with the air-quality of this community. It is not certain whether the results obtained from the analysers were communicated to the community. Quantitative information and voluntary comment indicates that the community did not take part in the entire process and, therefore, the community was not aware of company or municipal intervention in community hazard management. During the inauguration of the air-quality monitoring process, no community representative was present; the Speaker was the sole senior municipal representative.

To illustrate an attitude problem from the project initiators, this caravan was stationed in very unhygienic surroundings. The area was littered with solid waste. This per se cancelled the intended observation process. The littered environmental site was highlighted as an environmental problem to the Anglo Coal Environmental Project Officer during an interview. Speaking on condition of anonymity, the officer clarified that: ‘*little was considered of [about] the environment*’ and the site was chosen mainly as it stood at the centre and was probably the only open space in the community. The matter was also brought to the attention of the Speaker. The Speaker had very little to say, beyond confirming that the littered surroundings were as a result of the inability of the community to afford a skip bin.



Considering the outcomes from the quantitative information and voluntary comments, added to the responses from the Anglo Coal Environmental Project Officer and the Speaker of the municipality, few environmental factors were considered during the installation of the caravan. This community's opinion was not considered, which further illustrates the poor communication and relationship between the community, the mining industry and the municipality. This also applies to the *Basa njengo Magogo* project which was demonstrated to the community. Irrespective of the community demonstration process, only one respondent made a comment about any intervention in the community. This indicates that the tenets behind the air-quality monitoring process and the *Basa njengo Magogo* programme were not well articulated to the community. Two years after the demonstration had taken place (that is, in 2009), most community dwellers are still using their old *mbawulas*. A single reason was given for not using the modernised *mbawula*. The community dwellers asserted that, after the demonstration process, free modern *mbawulas* were not handed out to each family unit. Therefore, affordability is assumed to be the reason people are still using their old smoke-generating *mbawulas*.

This chapter provided a summary of the key features of the research outcomes and an interpretation of the quantitative information presented in Chapter 4. An analysis was also given of the key results of the quantitative data, the interviews and the focus group discussion as well as presenting photographic images supporting the findings. The next chapter, Chapter 7, contains conclusions and recommendations.

## 6.6 Conclusion

This chapter assimilates key ideas of the research finding and objectives i, ii, iii, iv and v. It brought together the final result of the research through an integration of quantitative and qualitative data from questionnaires, voluntary comments, individual interviews, focus group discussion and visual information (photographic images). The photographic images illustrate summarily by presenting and in accordance with the level of information obtain through community awareness, literacy and exposure to the actual physical and social situations of the research mining community. The integrated images, through light into the actual community outlook, in which one can inferred to the direct and indirect effects of mining in South African mining communities.

## **Chapter 7: CONCLUSIONS AND RECOMMENDATIONS**

*This chapter provides the conclusions drawn from the research findings. It outlines the effectiveness of hosting the WSSD and the review of the JPOI documents in the context of sustainable mining communities in South Africa. The chapter earmarks the successes and failures of the WSSD and contains recommendations on how to address these failures. It also outlines the constraints encountered during the research.*

### **7.1 Introduction**

A sustainable human settlement is a direct reflection of health, safety conditions and productivity. These factors serve as sustainable indicators in a mining community. These were some of the decisions arrived at during the WSSD in an attempt to reduce poverty and improve sustainable well-being. This idea was supported by other international organisations such as the World Coal Institute and Millennium Development Goals. The conclusions are based on the research findings discussed per heading topic and sub-topics (as detailed in Annexure 7).

### **7.2 Health and Safety**

Learners and community dwellers are aware of health hazards and the need for health and safety measures. However, their awareness is not sufficient to protect the community as most dwellers are not informed and educated about health and safety. The learners are not better informed and constitute a fraction of the general population. The fact that the community was unable to identify a pollutant gas in an area gazetted as a high air-pollution priority zone, indicates a serious shortcoming of the mining industries operating in the area, local government and the school curriculum. Causes of common diseases in the community are not known. Respondents could only make inference to a few common coal-dust-related diseases with certainty. Even those who named some of the common diseases inferred awareness from relatives and friends. No-one identified himself/herself as a victim of any disease.

Although voluntary comment responses added more insight into the research, it was more of a report submission. Voluntary comments made about the coal-mining industry and their operations were unfriendly. They included a number of grievances on health and

safety issues based on respondents' personal experiences. These were evidence of no formal relationship between the community and the mining industry. In many regards, the respondents were not happy with the state of the community environment. The school curriculum was inadequate, and appropriate channels of communication have not been used to conscientise the community about health and safety hazards from mining operations. All the foregoing indicates why hazards (physical and social) cannot be assessed in the studied mining community.

### **7.3 Disaster Preparedness and Awareness Response**

Insufficient awareness about the health hazards of coal is an indication of the type and nature of disaster-preparedness measures that are in place. The community is not aware of any disaster-preparedness measures initiated by the mining industry against coal hazards. With the exception of the air-quality monitoring process and the *Basa njengo Magogo* project which can be considered as an intervention in the community, neither the mining industry nor the community has initiated any disaster-preparedness measures and awareness response.

In every section of the research, lack of education and information were predominantly blamed by the community for their lack of awareness. The community itself has not initiated any disaster-preparedness and response measures, implying it is not anticipating any disaster. Voluntary information was more of a pleading session in which the respondents were requesting information and education from local government and the mining industry on disaster preparedness and awareness response. Most respondents identified a possible hazard from coal-mining and coal-processing operations within the community (plumes of smoke and spontaneous combustion), but were less aware of the potential risk of the identified hazards. Therefore, no individual disaster preparedness and possible collective preparedness measures existed.

### **7.4 Strategic Environmental Management Decisions/Planning**

The questions regarding strategic environmental management decisions/planning were initially designed to assess mining companies' policies on the environment and community. Subsequently only the community was assessed once the mining companies operating within the community declined to participate in the research. The failure of the targeted companies to participate indicates a failure in the broad sense of sustainable

development and sustainable mining communities. It also signifies a failure of the mining industries operating in this region. This was sufficient to determine the perception of the mining industries towards the community. Therefore community participation was poor and little information was expected. Community assessment was based on pre-knowledge that the community dwellers are less informed of industrial managerial policies. However, there was a further presumption that mine workers residing in the community, through interactions with friends and relatives, would be able to convey some industrial policies and decisions to the community,.

Results obtained from the community responses show little awareness on industrial environmental management decisions/planning. The multiple-choice questions also show a neutral response. Nine open-ended questions throw light on the confused state of the community. The community was unable to name even one project initiated in the community. Many examples were cited to prove that community dwellers are dissatisfied with their surroundings, with a good example being the health effects from diseases. In most of the responses, respondents were more certain to say 'No' (implying "*I do not know*"). Voluntary comments were more of a pleading session to the mining industry to educate and inform the community about decisions/planning that affect the community, than a session of genuine exchange of useful information from well informed volunteers.

## **7.5 Environmental Legal Application and Compliance**

Environmental legal application and compliance questions were intended for both the mining industry and the community. The intention was to assess industrial legal compliance. Again the mining industry declined to participate. Only the community was assessed directly and through third-party techniques. The response obtained was neutral, implying the community is unaware of existing environmental laws. They are also not aware of any legal application by a mining company or in the community. Most respondents denied receiving any information from a school or a mining industry. The response was questionable in an area designated in the National Environment Management: Air Quality Act, Act No. 39 of 2004 (RSA 2004), as amended by the Department of Environmental Affairs and Tourism (DEAT 2007) as an air-quality priority zone.

An open-ended question failed to identify any example by name of an environmental law known to the community. This is evidence that the community does not know any

named environmental legislation. Some were honest and noted at the side of the question “*I don’t know*”. This was the same with voluntary comments. Most voluntary comments identified with unawareness of any environmental legislation. They pointed out mining companies’ unwillingness to inform, educate and communicate with the community on any aspects including environmental rights. One miner asserted that they did not know about the National Environmental Management Act, Act No. 107 of 1998 (RSA 1998). Rather some respondents are aware of the International Standards Organisation (for example, ISO 14001 Environmental Management Systems), which dealt with international certification. Individual interviews and the focus group discussion all indicated unawareness of environmental laws. They all acknowledge the unhealthy state of the environment (hazards) and the existence of legislation but failed to give an example of an application at community level.

Conclusively, the level of community awareness was low at every aspect assessed. A combination of open-ended questions, voluntary comments, individual interviews and a focus group discussion added light to possible reasons for the low turnout at the focus group discussion. The municipal representatives (the Mayor and the Speaker) both distanced themselves from any direct environmental concerns, though they participated partially in the research process. The Ward Councillors exposed the municipality during the focus group discussion. The refusal by the mining industry to participate in this independent social research is indicative of the relationship between the community and the mining industry. It also relates to the nature of Corporate Social Responsibility within this research community.

State agencies like the Department of Mineral Resources and Energy, and the Department of Environmental Affairs and Tourism – responsible authorities for environmental issues – also declined to participate in this research which is indicative of lack of legislative enforcement. Therefore, the failure to educate the community on the adverse effects of mining may be blamed on the laxity of legislative enforcement by responsible authorities and the unethical responsibility of the mining industry. This shows the ineffectiveness of the WSSD and the unmet pledges to the JPOI by heads of State, and mining executives in the South African mining context and afield.

## 7.6 Main Summary and Conclusions

Coal-mining companies generally – and in South Africa – have embraced sustainable development in a comprehensive manner. By implication, this should encompass good relationships between communities and the authorities. Such relationships, if properly established, should promote the concept of sustainable development through creating community awareness on health impact and some impact of coal use. It could also establish cooperative governance with stakeholders in alignment with the policies arising from the WSSD. However, this research was not able to find sufficient evidence of a community in possession of any indicators of sustainable mining in South Africa. In effect, the WSSD, the JPOI and its associated partners (such as the World Coal Institute and the Global Reporting Initiative) policies have not influenced environmental behavioural change, practice and perceptions in the operational divisions of the coal-mining sector in South Africa. It has not provided an opportunity for the establishment of a coherent relationship between the mining industry, the community and the local authority. Though the guidelines are clearly outlined in the policy documents, there is no indication of any responses in cases of compliance failure.

The research findings did not reveal a coherent result between the WSSD and the JPOI policy documents on environmental, legal and ethical practice of the mining industry in the eMalahleni municipality. To expose the severity of this failure in environmental legal compliance and unethical responsibilities, mining companies within the research area agreed among themselves to decline participation in an independent research project probing corporate sustainability practice. Their failure to participate in independent research involving communities is indicative of their perception and implementation of sustainable development. It is also indicative of diversion from the WSSD policy document (Section 1 of the social and economic dimensions) and the JPOI (Section 1). It further revealed a lack of corporate social investment by the mining industry in this research community. This is evident as learners, community dwellers, the Mayor, the Speaker and the Ward Councillors could not identify by name any example of corporate social investment initiated by a mining industry.

The research findings revealed that the mining industry provides annual reports on mining activities in a handout with defined titles. These annual reports deal with coal-mining operations, internal mining practices and environmental reports. There is no evidence of coal being acknowledged as a hazard in these. More seriously, none of the

internal literature makes reference to coal as a hazard that can adversely affect the health of workers and the community. One might perhaps presume that the lack of adequate reports on coal hazards and their potential disaster on communities is encompassed in the broad nature in which mining companies have embraced sustainable development. This is among the reasons for the local mining companies declining to make any contribution to this research.

This research revealed a trend of weakness emanating from the unethical responsibilities and practices of mining companies. The research revealed a gap in the negative social and economic impact of coal-mining and coal-processing on communities. An insight into this trend was clearly revealed in the open-ended questions, voluntary comments, individual interviews and the focus group discussion. Most voluntary comments showed an interest to receive information. Individual interviews and the focus group discussion revealed the level of knowledge on coal hazards by the local authority and the community elders. The most unexpected revelations came from the Ward Councillors, who were not aware of the definition of “hazard(s)” and repeatedly made requests for it to be re-defined. The incoherent administrative relationship between the local government and mining authorities was exposed when a Ward Councillor declared that *‘there has never been a discussion forum such as this’*, referring to the focus group discussion. Even the nature of questions posed by the Ward Councillors revealed evidence of ignorance. The manner in which the Speaker adjourned the first focus group discussion and then his failure to attend the rescheduled session are evidence of embarrassment on the part of local authorities. To further support the revealing evidence of the level of awareness within the local authorities, the most senior representatives (Mayor and Speaker) exercised an aggressive and defensive attitude during the individual interviews and when responding to questions posed during the focus group discussion.

The examination of the WSSD documents revealed that the guideline principles are useful and relevant for environmental management. However, this research revealed that lack of enforcement and effective supervision at all levels of government has rendered this tool ineffective as shown in the studied area. By implication, the initial accord between government and industries (JPOI), in which signatories were pledged as evidence of commitment has not been respected. Therefore the role of the government in enforcing sustainable development in mining communities is ineffective. This remains a major

challenge on how to deal with the adverse social and environmental effects of mining on communities within the broader context of sustainability.

Even worse is the prevailing situation in one of the mining communities in South Africa - the Marikana tragedy (Alexander *et al.*, 2012). A combination of social, economic and political factors, such as poor working conditions, poor living conditions, income differentiation, community neglect, lack of social infrastructures, no visible corporate social investments, community insolvency, lack of information among stakeholders, inadequate education on the hazards associated with mining activities, resulted in a crippling strike that led to the death of 34 striking mine works, four police officers and a serious disruption of mine production through a series of unsanctioned strikes.

## 7.7 Constraints

This research included aspects of human behaviour and human practice in a living and working environment and demonstrated problems that have not been addressed. These weaknesses were both inside and outside the community. Internal constraints involve limitations in the research process and the research institution. External constraints involve external bodies or organisations, such as related and mining industries. This involved also persons on whom the research depended for information and other support.

### 7.7.1 *Internal Research Constraints*

The most strenuous of the constraints was how to approach an unfamiliar community with linguistic differences. The need for an interpreter who lives within, and is familiar with, the community was imperative. An interpreter who could speak English as a second language and was able to relate to the local community without diverting the content was not easy to find. Even more arduous was the fact that the researcher could neither understand nor speak any of the local languages. Therefore everything translated by the interpreter had to be considered as correct. Furthermore, the interpreter was not a trained linguist and not familiar with the research domain. Therefore, she had to be taught the content of the research in English prior to accompanying the researcher on his visits to the community.

Technical terms in the research were unfamiliar to the respondents (community), for example, “hazards” and “pollutant gas”. The fact that interviews were conducted on work days and during work time was a weakness in the study design. This limitation was



imposed in part by logistic and distance constraints. It resulted in skewed sampling of the general population towards unemployed persons, pensioners or home carers. The age restriction (minimum age 17 years) imposed on schools eliminated all of the under-age learners, so this sample fairly represented young adults with an intended bias towards those receiving an education at senior secondary school level (Grades 10 and 11).

The main focus group discussion – which was a participatory opportunity with councillors of the local government authority – was derailed. The participants upset the agenda through several questions and challenges posed to the researcher. Nevertheless, these interjections provided a good opportunity to understand their level of environmental awareness and their frustration at not having better information and education relating to this topic. The very act of rejecting the agenda and the hostile questioning became valuable data to address the research questions.

The total refusal of the mining companies to participate in any way in the research was also a rejection of the agenda and, in its own way, provided data that informed the research question. It exposed the perception and practices of the mining industry towards intrinsic research of this nature. It also warranted many questions regarding the understanding of sustainable development, the purpose for which the WSSD was hosted and the possibly hypocritical signing of the Johannesburg Plan of Implementation. The central answer was mining companies were reluctant to have their environmental practices subjected to critical external scrutiny. This concurred with an anonymous email sent by a company senior environmental officer explaining why the mining companies were not willing to assist in the research.

Though the research probed the situation in only one community, the results may be generalisable to other communities living in similar industrial areas elsewhere in particularly South Africa and on the African continent and the developing world in general.

### **7.7.2 External Research Constraints**

There were more external than internal constraints to this research. The research depended on people, organisations, industries and municipal inputs to be realised. These groups of people played different roles in their contributions. The biggest problem was identifying the role players at every level. Mining companies as major role players in this research

declined participation from the onset, irrespective of six months of negotiations and persuasion, including personal interventions by the researcher's supervisor. To emphasise the reality, the coal-mining operations in the eMalahleni municipality aligned with one another to reject any request for interviews or participation, and only a conscientious senior environmental officer, who politely requested not to be identified, wrote the researcher an honest email response, with the caveat: "*Please don't mention my name*". The email states: "*They are refusing to help you on grounds that the research title is very sensitive.*"

Other constraints arose from the contacted individuals and where to start the research. Many people were contacted, some gave very friendly responses and some not. Research permits were needed from the Municipality, the Department of Education and the Department of Minerals and Energy. These permits were not issued readily. Much explanation, many letters of motivation and persuasion about the purpose and value of the research were needed to obtain them.

Schools were visited and research permission was submitted to the schools to obtain authorisation for conducting the research. Community dwellers were contacted individually or in small groups which was not easy. The researcher had to visit the community during convenient times (for example, not during meal times or other private family time) to make contact with individuals. More than one appointment was scheduled per day. Sometimes school activities took precedence over the research interest and the appointment had to be postponed. Community dwellers were mostly illiterate and obtaining their involvement was difficult. Dealing with learners was also challenging – it was not easy for them to understand why the research was necessary. A simple class presentation was given. Teachers, who were looked upon as respected professionals who could easily understand the purpose and value of research, were mostly passive. In some schools, the participation level of teachers was lower than that of the learners.

The municipality, a key role player in the community, which issued permission for the research to take place, fell short of effective participation. They cancelled the focus group discussion and declined to participate in a follow-up focus group discussion. One reason could have been *insufficient political exposure*. Documents requested (and promised by the local government authorities) from the environmental committee portfolio, were never provided. One might surmise that these documents were not carefully archived or restricted for other reasons. The Department of Minerals and Energy in

Pretoria also turned down an interview because of ‘... *too busy to assist in any research*’. Department of Energy and the Department of Environmental Affairs in eMalahleni also declined to participate in the research.

## 7.8 Recommendations on further research

The research recommends that in order to recover the values attached to the World Summit on Sustainable Development and the Johannesburg Plan of Implementation, the following should be implemented or adhered to:

- The signatories of the World Summit on Sustainable Development and the Johannesburg Plan of Implementation should re-examine the guidelines that were stipulated during the signatory process to understand what commitments they agreed to uphold. This action should rekindle the initial commitments and interest.
- Stakeholders should accept their sustainability roles and responsibilities as required by national policies and international conventions. These roles and responsibilities should be implemented diligently.
- All spheres of government (national, provincial and local) should collaborate to enforce by-laws relating to environmental management in the process of transformation. This should be mindful of what sustainable transformation requires at national and local levels.
- The national government should outline a national sustainability implementation plan, to be enforced by all local authorities and industries extracting a similar natural resource, for instance, coal. Such an implementation plan should relate to the guidelines of the Johannesburg Plan of Implementation, with specific strictness relating to certain aspects, as may suit the government and communities.
- As a requirement of a national implementation plan, environmental campaigns should be prioritised, involving all stakeholders (communities, companies and local authorities). Within this national framework, aspects such as community education, information and communication should be targeted tools of campaigns focused on communities close to mining sites, industrial zones or abandoned mines.
- Providing information to mining communities should be a national priority in which the mining industry should furnish communities with relevant

environmental and sustainability literature and information annually. Available literature should include academic and other research done in the community. Various channels of communication, such as schools, Ward Councillors and the entire Mayoral office, should be deployed to disseminate information to communities.

- Corporate and operational managers should be mindful of their sustainability responsibilities in terms of poverty alleviation, sustainable energy consumption, good health-care and sanitation, education and information, among others, in communities where basic amenities are lacking, such as in the present study.

Once a national sustainability policy is accepted and executed as part of sustainable development practice, there might be hope of rescuing the tenets and the purpose of the World Summit on Sustainable Development and the Johannesburg Plan of Implementation. Such a national sustainability policy should follow a sequential implementation process, devolving from the national, to provincial to local levels, in which communities stand to benefit through the creation of meaningful sustainable relationships between communities and mining industries. The community should not only serve as a source of labour but also as a reliable business partner to mining industries. Extensive benefits could follow, as communities would be able to independently assess their living environment and to communicate with other stakeholders, notably companies and the State should any anomalies arise. By so doing awareness and other forms of knowledge would be reciprocated within communities and mining companies in a mutual development pattern to benefit all stakeholders. Through such processes, hazards could be assessed and early disaster mitigation measures ensured. Hence, a sustainable mining community could be established in which coal-mining and coal-processing hazards and disaster-preparedness measures are effectively established to minimise and possibly eliminate coal-mining and coal-processing related disasters at community level.



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## **Annexures**

This section contains eight annexures, numbered as Annexure 1-8. Each annexure contains specific information that contributes to the overall understanding of the thesis or archiving of full tables of results.



## **Annexure 1: Example of an American Coal Mine Disaster at Sago Mine, Tallmansville, West Virginia**

The Sago mine disaster is a coal mine explosion that occurred on 2 January 2006, in Tallmansville, West Virginia, USA, where thirteen miners were trapped underground for nearly two days. It is believed to be the worst mine disaster in West Virginia since 1968. The disaster claimed 78 lives (USDL n.d.). Rescue efforts failed and only one out of the thirteen trapped miners survived (Langfitt 2006b; McAteer et al. 2006). The story is full of controversies and miscommunication. This is an example of lack of disaster preparedness at the workplace with consequences stretching from the workplace, to the mining house, the communities and the State.

The incident occurred during the first shift, after the mine had closed for a New Year holiday. An inspection at 05:50 cleared the mine for use. Two carts of miners were making their way into the mine to begin work. The first entered the mine approximately eight to ten minutes before the second. The explosion occurred at approximately 06:30 and was heard and felt outside the mine. *It is not known what triggered the explosion* (McAteer et al. 2006:38). Some early reports noted that there was a thunderstorm in the area at the time and suggested a lightning strike near the mineshaft may have ignited volatile gases, though no one reported seeing a lightning strike (Foremann 2006).

Twenty-nine miners were underground during the blast. *Thirteen were in close proximity to the blast* (McAteer et al. 2006:35). According to these authors, one miner was killed instantly, while twelve others failed to find their way out after the blast. Another sixteen miners that were further away from the blast, including the mine superintendent, escape unharmed.

### **Rescue Efforts Delayed**

According to Ward Jr (2006), an investigative reporter for the *Charleston Gazette* confirmed that the company did not call on specialised mine rescuers until 08:04, more than 90 minutes after the blast. The federal Mine Safety and Health Administration (MSHA) was notified at 08:30 and could only arrive at 10:30. Rescuers waited 12 hours after the explosion to reach the miners due to the high concentration of carbon monoxide (CO) and methane gas (CH<sub>4</sub>) in the shaft (SD&M n.d.). Holes were drilled from the surface



and tests conducted. The tests proved that the air where the miners were last known to be contained 1 300 parts per million (ppm) of carbon-monoxide. The blast disabled the mine internal communications system, so the condition of the thirteen miners was unknown. They had air-purifying equipment that would give seven hours of breathable air, but no oxygen tanks (SD&M n.d.). Rescuers had to proceed with care. Safety regulations required that they continually test for dangers to themselves such as water seepages and gas concentrations, limiting their rate of progress to 1 000 feet (305 m) an hour. Checking was done in every 500 feet (152 m), and then they disconnected their telephones until the next checkpoint, to avoid the possibility of a spark which might create another explosion (SD&M n.d.).

### **Locating the Trapped Miners**

By 12:40 on January 3, the rescue teams had made the 10 200 feet (3 109 m) into the mine. At the time, it was believed that the trapped miners were somewhere between 11 000 and 13 000 feet (3 352 and 3 962 m) along the shaft. Two 6.25 inch (159 mm) holes were drilled into the mineshaft from above into areas where the miners were believed to be. Microphones and video cameras lowered into them for ten minutes did not find any signs of life. *'Air quality tests performed through the first hole on the morning of January 3 indicated that CO levels in that part of the shaft were at 1 300 parts per million tolerance of the human body. Officials called this 'very discouraging' (SD&M n.d.:2).*

The first report on the condition of the miners came just before 17:00 on 3 January. It was reported that the body of one miner had been found. Hours later, just before midnight reports spread quickly that all twelve of the remaining miners had been found alive, but these reports were false (McAteer et al. 2006:35; SD&M n.d.). Thirty minutes later a rescue team confirmed that twelve of the miners were found dead and one in a critical condition. The International Coal Group Chief Executive Officer, Ben Hatfield, confirmed that there was only one survivor, three hours after reports first surfaced of twelve survivors (SD&M n.d.).

### **Miscommunication and Wrong Reports**

About 23:50 on 3 January, news services including the Associated Press and Reuters reported that twelve of the thirteen miners had survived, attributing the report of survivors to the family members (Langfitt 2006a, 2006b). CNN.com and other websites sported

headlines including, “We got 12 alive”, as well as, “Believe in miracles: 12 miners found alive”.

There was a miscommunication between mine management and the general public (McAteer et al. 2006:35). This emanated from poor reporting and information transfer. *Hatfield stated that he asked State troopers to inform clergy to tell people inside Sago church that there were now conflicting reports (SD&M n.d.:3)*, which notes further that this information never reach family members, who expressed anger after clarification.

Without giving a reason for the miscommunication and without assigning blame, Hatfield said he deeply regrets allowing the jubilation to go on longer than it should have (Smith 2006). He confirmed the miscommunication at a press conference shortly thereafter citing many reasons. Initial information indicated that the miscommunication occurred between the rescue team in the mine and the command centre at the surface. According to Hatfield, several personnel at the centre were able to simultaneously hear the communications directly from the rescue team. The rescuers were working under full-face oxygen masks, through extreme stress and physical exhaustion and communicating in code over a possibly spotty connection. Any of these conditions, or a combination thereof, could have contributed to the miscommunication (SD&M n.d.).

### **Blame for the Disaster**

The tense atmosphere resulted in blame being attributed to all parts of the economy. The faults ranged from the company itself, the International Coal Group (ICG), to political and socio-economic aspects. Faults attributed to the company itself were physical and managerial. In 2005, the mine was cited by the federal MSHA 208 times for violating regulations, up from 68 in 2004. Of those, 96 were considered significant and substantial. The West Virginia office of Miner’s Health, Safety and Training issued 144 citations over the year, up from 74 the previous year (MSNBC n.d.).

Some of those citations were for violations that may have been responsible for the accident, such as failure to control methane and coal-dust accumulation, improperly shore up shafts against collapse and overall lacking in emergency planning. According to MSHA inspections from early October to late December (2004) resulted in 46 citations and three orders, eighteen of which were ‘*serious and substantial*’. Violations include failure to follow the approved roof control, mine ventilation plans, no emergency escape ways and pre-shift safety examination. From early July to late September, MSHA found 70



violations, 42 of which were *serious and substantial*, MSHA found 52 violations from April to June, of which 31 were *serious and substantial* (MSNBC n.d.). These *serious and substantial* violations are those that MSHA believes are likely to cause an accident that would seriously injure a miner.

Davitt McAteer, MSHA chief during the Clinton administration, confirmed (SD&M n.d.:4):

*The numbers do not sound good ...[they are] sufficiently high that it should tip off management that there is something amiss here. For a small operation, that is a significant number of violations.*

The MSHA reported on its website that none of the violations was considered to be an *immediate risk of injury* (SD&M n.d.:4) and that all but three violations, related to shoring up the roof, were corrected by the time of the accident. A total of 208 citations, orders and safeguards was issued in 2005, several involved significant violations that were the result of high negligence. MSHA ordered that mining cease in the affected area until the unsafe conditions were addressed. Only eight violations of the total citations were corrected by the operator. The rest were under consideration by mine management.

Mining operations at the Sago Mine more than doubled between 2004 and 2005 and the injury rate was significantly above the national average. This prompted MSHA to dramatically increase, by 84 %, its on-site inspection and enforcement presence. As a result MSHA also took significantly more enforcement actions, 208 in total, against Sago Mine in 2005, which required the operator to quickly correct health and safety violations in accordance with federal Mine Act Standards (SD&M n.d.).

The West Virginia government launched an investigation into the mine safety affair. A team of sixteen experts was headed by the ex-MSHA chief to oversee investigation process. The probe was announced by Joe Manchin, Governor of West Virginia, in the 10 January 2006 edition of the *Charleston Gazette* (MSHA 2006).

The Sago Mine disaster is a good example of a mining incident where time, money, social distrust, community misery, the State and politicians' issues were jeopardised due to negligence and lack of disaster preparedness.

## Annexure 2: Sustainable Development Report Card for the SA Mining Industry

**Table A2.1: Illustrating the sustainable development report card for the South African mining industry: Economic contribution made by mining 2000/2001 and 2004/2005**

<b>Economics</b>		
<b>GENERAL</b>	<b>2000/2001</b>	<b>2004/2005</b>
Value of market capitalisation on the JSE	R690 billion (41.5 %)	R534 billion (35.3 %)
Mining contribution to GDP		Direct: 6.6 % Induced: ~16 %
BEE ownership deals		R50 billion
<b>SALES</b>		
Total mineral sales	R98 billion per annum	R124.9 billion per annum
Value of minerals products exported		US\$19.4 billion per annum
	Including beneficiated products: >60 %	Including beneficiated products: >50 %
Proportion contributed to total merchandise exports	Excluding beneficiated products: 34 %	Excluding beneficiated products: 29.3 %
Number of countries to which mineral commodities are exported	87	>100
<b>SUPPLIERS</b>		
See more detailed product and service statement below		
Procurement from BEE firms		>R3 billion per annum
<b>EMPLOYEES</b>		
Wages and benefits	R24.5 billion per annum	R34.3 billion per annum
<b>GOVERNMENT</b>		
Direct taxes		R6.98 billion per annum
Other taxes		R4.1 billion per annum
<b>INVESTMENT</b>		
Proportion of total fixed investment in the economy		9.90 %
Proportion of private sector investment in the economy		14 %
Approved capital projects (2004-2008)		R90 billion

(Source: SAMISTR 2005:4).

**Table A2.2: Illustrating sustainable development report card for the South African mining industry: products and services 2005.**

Product and Services	Million Rand	%
Transport services	9 415	46.3
Professional services and training	2 407	11.8
Electricity	2 272	11.2
Retail and wholesale trade	1 449	7.1
Other business services	708	3.5
Other goods: hardware, plastic, rubber and steel products	693	3.4
Raw materials: water, coal, cement, basic chemicals, etc.	544	2.7
Chemical products: mainly explosives	505	2.5
Financial intermediation services	349	1.7
Mining machinery	349	1.7
Other services: insurance, communications etc.	342	1.7
Wood products: mainly mining support	325	1.6
Other fabricated metal products	280	1.4
Civil engineering: construction and site preparation	276	1.4
Machinery: pumps, gears, engines, electric motors	206	1.0
Motor vehicle, parts and tyres	195	0.9
<b>Total products and services purchased</b>	<b>20 315</b>	<b>100</b>

(Source: SAMISTR 2005:4).

## Annexure 3: Balance Sheet of Mining Companies 2004

**Table A3.1: Cost-accounting balance sheet of mining companies as at 30 June 2004**

<b>Balance sheet: 30 June 2004</b>			
<b>Assets</b>	<b>Notes</b>	<b>R</b>	<b>R</b>
<b>Non-current assets</b>			
Equipment	1	561 806	1 058 637
Inventory		289 320	248 258
Investments	2	10 766 932	13 587 583
		<b>11 618 058</b>	<b>14 894 478</b>
<b>Current assets</b>			
Accounts receivable			
Administered fund	3	11 265 958	13 034 341
Bank and cash	4	65 236 383	64 315 066
<b>Total assets</b>	<b>4</b>	<b>9 266 119</b>	<b>6 334 517</b>
		85 768 460	83 683 924
		<b>97 386 518</b>	<b>98 578 402</b>
<b>Funds and liabilities</b>			
<b>Funds</b>			
<b>Accumulated funds</b>			
Project funds		6 521 247	6 521 247
	5	13 127 359	17 759 138
		<b>19 648 606</b>	<b>24 280 385</b>
<b>Current liabilities</b>			
Amount owing to associates in respect of funds managed on their behalf			
Accounts payable	10	65 236 383	64 315 066
Short-term loan	6	8 940 909	6 422 665
	7	3 560 620	3 560 286
<b>Total funds and liabilities</b>		<b>77 737 912</b>	<b>74 298 017</b>
		<b>97 386 518</b>	<b>98 578 402</b>



## Income statement for the year ended 30 June 2004

### Revenue

Administrative and operating costs	8	42 083 352	40 711 420
Surplus before depreciation	9	-41 341 249	-40 021 593
Depreciation		742 103	689 827
Operating surplus		-543 047	-689 827
Project income		199 056	0
Project expenditure		216 438	3 494 277
(Decrease)/increase in project funding		-5 047 273	-2 864 442
		<b>-4 631 779</b>	<b>629 835</b>

## Statement of changes in equity for the year ended 30 June 2004

Balance at 30 June 2002	Note	Project funds	Accumulate d funds	Total funds
Increase in project funding for the year		17 129 303	6 521 247	23 650 550
Transfer to project funds		0	629 835	629 835
Balance at 30 June 2003		629 835	-629 835	0
Decrease in project funding for the year		17 759 138	6 521 247	24 280 385
Transfer from project funds		0	-4 631 779	(4 631 779)
Balance at 30 June 2004	5	-4 631 779	4 631 779	0
		<b>13 127 359</b>	<b>6 521 247</b>	<b>19 648 606</b>

## Cash-flow statement for the year ended 30 June 2004

		2004	2003
		R	R
<b>Cash flows from operating activities:</b>			
Net cash (outflow) inflow from operating activities			
<b>Cash flows from investing activities:</b>			
Additions to equipment	A	-499 800	3 811 161
Investment income	B	(46 216)	-408 255
Decrease (increase) in investments		1 578 284	3 257 512
Net cash inflow from investing activities		2 820 651	-619 181
		<b>4 352 719</b>	<b>2 230 076</b>
Net increase in cash and cash equivalents		3 852 919	6 041 237
<b>Cash and cash equivalents at the beginning of the year</b>			
<b>Cash and cash equivalents at the end of the year</b>		<b>70 649 583</b>	<b>64 608 346</b>
		<b>74 502 502</b>	<b>70 649 583</b>

**Notes to the cash-flow statement for  
the year ended 30 June 2004**

**A. Reconciliation of  
(decrease)/increase in project  
funding for the year to net cash  
flow from operating activities**

(Decrease)/Increase project funding for  
the year

	R	R
Adjustment for:	-4 631 779	629 835
Depreciation		
Issue of inventory for no value	543 047	689 827
Interest received	8 555	16 027
	-1 578 284	3 257 512

**Operating funding before working  
capital changes**

	-5 658 461	-1 921 823
--	------------	------------

**Working capital changes**

Decrease/(increase) in accounts  
receivable

Increase in accounts payable and amount  
owing to associates in respect of funds  
managed on their behalf

Increase in loans

Increase in inventory

	1 768 383	-4 775 494
	3 439 561	10 507 315
	334	1 163
	-49 617	0
	<b>5 158 661</b>	<b>5 732 984</b>

**Note cash (outflow) inflow from  
operating activities**

	-499 800	3 811 161
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**B. Additions to equipment**

Motor vehicles

Computer equipment

Furniture and fittings

	0	-240 085
	-10 427	-98 170
	-35 789	-70 000
	<b>-46 216</b>	<b>-408 255</b>

**C. Cash and cash equivalents**

Administered fund

Bank and cash

	65 236 383	64 315 066
	9 266 119	6 334 517
	<b>74 502 502</b>	<b>70 649 583</b>

(Source: CoM 2004:137-139).

**Table 31: Example of annual financial accounting statements for a mining company for the financial year ended 30 June 2004**

**Notes to annual financial statements for the year ended 30 June 2004.**

**1. Equipment**

2004	Cost	Accumulated depreciation	Net book value
	R	R	R
Motor vehicles	1 273 705	932 826	340 879
Computer equipment	425 295	319 622	105 673
Furniture and fittings	328 708	213 454	115 254
	<u>2 027 708</u>	<u>1 465 902</u>	<u>561 806</u>
2003			
Motor vehicle	1 273 705	545 025	728 680
Computer equipment	414 869	210 726	204 143
Furniture and fittings	292 919	167 105	125 814
	<u>1 981 493</u>	<u>922 856</u>	<u>1 058 637</u>

2004

Reconciliation of movement:

	Motor vehicles	Computer equipment	Furniture and fitting	Total
	R	R	R	R
Net book value at beginning of year	728 680	204 143	125 814	1 058 637
Additions		10 427	35 789	46 216
Depreciation	-387 801	-108 897	-46 349	-543 047
Net book value at end of year	<u>340 879</u>	<u>105 673</u>	<u>115 254</u>	<u>561 806</u>

**2. Investments**

	R	2004 R	2003 R
Unlisted shares at cost			
Chamber of Mines Training College 10 shares @ R2	20	64	64
Audit Bureau of Circulation 2 shares @ R2	4		
Rand Mutual Assurance Co. Ltd 2 shares @ R20	<u>40</u>		
Executive valuation	<u>64</u>		
		64	64
Term deposits:			
Industrial Task Force Radiation fund		1 541 383	2 460 004
Disaster Relief fund		740 000	740 000
Insurance Claim fund		880 000	880 000
Rural Development and Research fund		6 540 427	7 441 174
HIV/Aids projects		445 820	630 000
Litigation fund		<u>619 238</u>	<u>1 436 341</u>
		<u>10 766 932</u>	<u>13 587 583</u>

### 3. Accounts receivable

Accounts receivable – members	11 197 119	12 249 145
Other accounts receivable	883 235	940 706
	<u>12 080 354</u>	<u>13 189 851</u>
Less: Provision for doubtful debts	-814 396	-155 510
	<u>11 265 958</u>	<u>13 034 341</u>

### 4. Bank and cash

<b>Administered fund</b>	<u>65 236 383</u>	<u>64 315 066</u>
Cash at bank and on call	20 032 987	19 922 036
Amount classified under investments	<u>(10 766 868)</u>	<u>-13 587 519</u>
Bank and cash	<u>9 266 119</u>	<u>6 334 517</u>

### 5. Project funds

Rural development		5 935 517	6 591 087
Balance at July 2003	6 591 087		
Expenditure	<u>-655 570</u>		
Balance at 30 June 2004	<u>5 935 517</u>		

Disaster Relief		740 000	740 000
This fund was established for disaster relief projects.			

Insurance		880 000	880 000
This fund was established to meet potential claims against the Chamber			

Research		604 910	850 087
Balance at 1 July 2003	850 087		
Interest	54 823		
Expenditure	<u>-300 000</u>		
Balance at 30 June 2004	<u>604 910</u>		

This fund was established to partially fund the Deep mine and Coaltech 2020 projects

Industry Task Force Radiation Fund		1 541 383	2 460 004
Balance at 1 July 2003	2 460 004		
Interest	161 615		
Expenditure	<u>-1 080 236</u>		
Balance at 30 June 2004	<u>1 541 383</u>		

This fund was established to clean up certain specified contaminated sites.

HIV/Aids project		445 820	630 000
Balance at July 2003	630 000		
Expenditure	-184 180		
Balance at 30 June 2004	<u>445 820</u>		
<b>General Fund</b>			
Other		1 350 122	1 429 362
Jewellery Industry Export Council		0	75 000
Legal Opinion		396 800	597 000
Building repairs and essential maintenance		613 569	1 070 257
Hollard Street Mall Fund		0	1 000 000
		<u>2 360 491</u>	<u>4 171 619</u>
Litigation Fund		619 238	1 436 341
Balance at 1 July 2003	1 436 341		
Expenditure	-817 103		
Balance at 30 June 2004	<u>619 238</u>		
		<u>13 127 359</u>	<u>17 759 138</u>

#### 6. Accounts payable

Accounts payable-members (refund BUSA subscription)	600 000	0
Other accounts payable	8 340 909	6 422 665
	<u>8 940 909</u>	<u>6 422 665</u>

#### 7. Short-term loan

Chamber of Mines Building Company (Pty) Ltd	<u>3 560 620</u>	<u>3 560 286</u>
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This loan is unsecured, interest free and payable on demand.

#### 8. Revenue

Contribution from members	36 996 046	34 277 698
Interest	1 578 284	3 257 512
Administration fees	828 700	982 356
Other income	2 680 322	2 193 854
	<u>42 083 352</u>	<u>40 711 420</u>

#### 9. Administrative and operating expenditure

Auditors' remuneration	180 521	170 430
	150 000	139 000
	0	24 930
Other services	30 521	6 500
Staff costs	26 676 284	25 804 423
Operating costs	<u>14 484 444</u>	<u>14 046 740</u>

(Source: CoM, 2004:141-144).



## Annexure 4: Questionnaires used on Community Hazards and Disaster Preparedness Assessment in Coal Mining and Industry

Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_ Age \_\_\_\_\_

Years of Residence \_\_\_\_\_ Date \_\_\_\_\_

<b>HEALTH AND SAFETY: DUST EXPOSURE</b>					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of dust coming from mines?				
2.	Are you aware of dust within the community attributed to mining activities?				
3.	Are you aware whether any mining company carries out dust control within the mining community?				
4.	Are you aware of the hazards of coal-dust exposure?				
5.	Has any mining company ever educated your community on the hazards of coal-dust?				
6.	Has the municipality ever educated your community on the hazards of coal-dust?				
7.	Are there any reports or information provided to your community on dust control by a mining company?				
8.	Are you interested to know about coal-dust control by a mining company?				
9.	Is there any clinical survey/report done on coal-dust-related diseases within your community?				
10.	Are the workers informed about coal-dust and related diseases from coal dust?				
Comments:					





Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

<b>HEALTH AND SAFETY: TEMPERATURE AND HEAT EXPOSURE</b>					
	<b>Question</b>	<b>Yes</b>	<b>No</b>	<b>Sometimes</b>	<b>Other</b>
1.	Are you aware of temperature and heat as hazards?				
2.	Do you sometimes feel an abnormal temperature and heat increase likely as a result of mining processes?				
3.	Has a mining company ever educated your community on the hazards of temperature and heat exposure?				
4.	Has the municipality ever educated your community on the hazards of temperature and heat exposure?				
5.	Has information ever been provided to communities on the hazards of temperature and heat exposure?				
6.	Are you aware whether mine workers are informed about the hazards of temperature and heat exposure?				
7.	Are you aware whether mine workers are tested for temperature and heat-related diseases?				
8.	Are you interested to know about mining company temperature and heat control measures?				
<p>Comments:</p>          					





Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

HEALTH AND SAFETY: COAL-MINING AND COAL-PROCESSING GASES					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of gases generated during coal-mining and coal-processing operations?				
2.	Which are the various gases known to your community? 2(a):..... 2(b):..... 2(c):.....				
3.	Has a mining company ever educated your community about the existence of various coal-mining and coal-processing gases?				
4.	Has the municipality ever educated your community about the existence of various coal-mining and coal-processing gases?				
5.	Has information been provided to your community about the existence of coal-mining and coal-processing gases?				
6.	Are you aware about the hazards of coal-mining and coal-processing gases?				
7.	Are you aware whether mine workers are informed about the various coal-mining and coal-processing gases?				
8.	Are you aware whether mine workers are informed about the hazards of the various coal-mining and coal-processing gases?				
9.	Are you aware whether mine workers are tested for various coal-mining and coal-processing gas-related diseases?				
10.	Have you been tested for any coal-mining and coal-processing gas-related diseases?				
11.	Are you interested to know how a mining company manages the various coal-mining and coal-processing gases?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

HEALTH AND SAFETY: HEALTH AND HAZARD EXPOSURE					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of any coal-related health hazards?				
2.	If "Yes", state any coal-related diseases you know of. 2(a): .....				
3.	Have you suffered from any coal-related illness?				
4.	If "Yes", state any coal-related illness you have suffered from. 4(a):.....				
5.	Do you know anyone who has suffered from a coal-related disease?				
6.	If "Yes", state your relationship with the person. 6(a): .....				
7.	Has he/she ever worked at a coal-mining company?				
8.	Do you know anyone who has died from a coal-mining-related disease?				
9.	Are you interested to know about the health hazards of coal and related illnesses?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

<b>DISASTER PREPAREDNESS AND AWARENESS RESPONSE: COAL FIRES AND FIRE-FIGHTING EQUIPMENT</b>					
	<b>Question</b>	<b>Yes</b>	<b>No</b>	<b>Sometimes</b>	<b>Other</b>
1.	Are you aware of coal fires within your community?				
2.	Are you aware of the hazard of coal fires in your community?				
3.	Are you aware of mining company fire-fighting efforts in your community?				
4.	Are you aware of mining company fire-fighting equipment within your community?				
5.	Has a mining company ever informed your community about fire-fighting efforts?				
6.	Has the municipality ever informed your community about mining company fire-fighting efforts?				
7.	Has a mining company ever informed your community about the hazards of coal fires?				
8.	Are you interested to know about the hazards of coal fires?				
9.	Are you interested to know how a mining company combats coal fires?				
10.	Are the workers from your community aware of the hazards of coal fires?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

DISASTER PREPAREDNESS AND AWARENESS RESPONSE: AIR-QUALITY MONITORING					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the value of good quality air?				
2.	Are you aware of the hazards of bad air?				
3.	Are you aware of mining company air-quality monitoring?				
4.	Has a mining company ever informed the community about the value of air-quality monitoring?				
5.	Has the municipality ever informed the community about the value of air-quality monitoring?				
6.	Are you interested to know about mining company air-quality monitoring?				
7.	Are the workers from your community aware of the hazards of coal-mining and coal-processing on air-quality?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

DISASTER PREPAREDNESS AND AWARENESS RESPONSE: EXPLOSIVES AND EXPLOSIONS					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of explosives?				
2.	Are you aware of the use of explosives during coal-mining?				
3.	Has a mining company informed your community about the use of explosives in mines?				
4.	Has the municipality ever informed your community about company use of explosives in mines?				
5.	Are you aware of the hazards associated with the explosives?				
6.	Are you interested to know about the hazards of explosives?				
7.	Are you interested to know how a mining company protects the community from the hazards arising from the use of mine explosives?				
8.	Are the workers from your community aware of the hazards of mine explosives?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

<b>DISASTER PREPAREDNESS AND AWARENESS RESPONSE: UNDERGROUND SURVEILLANCE</b>					
	<b>Question</b>	<b>Yes</b>	<b>No</b>	<b>Sometimes</b>	<b>Other</b>
1.	Are you aware of company surveillance on mines?				
2.	Are you aware of company underground surveillance in mines?				
3.	Has a mining company ever informed your community about underground surveillance on mines?				
4.	Has the municipality ever informed your community about a mining company underground surveillance?				
5.	Are you interested to know about mining company underground surveillance?				
6.	Are the mine workers from your community aware of mining company underground surveillance?				
7.	Are the mine workers from your community aware of the need for company underground surveillance?				
Comments:					

**Comments:**



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

STRATEGIC ENVIRONMENTAL MANAGEMENT: ENVIRONMENTAL HAZARDS AND PLANNING DECISIONS					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of mining hazards that surround your community?				
2.	Are you aware of company environmental decisions / planning in hazard management?				
3.	Has your community any specific decisions against mining hazards?				
4.	Name two coal-mining hazards that you know in your community. 4(a): ..... 4(b): .....				
5.	What is your decision about such mine hazards? 5(a): ..... 5(b): .....				
6.	Is there a communication link between your community and a mining company?				
7.	Has a mining company informed your community about environmental hazard decisions and planning?				
8.	Has your community participated with a mining company on environmental hazard decisions?				
9.	Is there any environmental project initiated by a mining company in your community?				
10.	Is there any socio-economic investment made by a mining company in your community?				
11.	Name two projects in your community. 11(a): ..... 11(b): .....				
12.	Are you happy with your surroundings?				

13. What aspects are pleasing and unpleasing within your surroundings? Name two each.

Pleasing:

13(a): .....

13(b): .....

Unpleasing:

13(c): .....

13(d): .....

Comments:





Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

STRATEGIC ENVIRONMENTAL MANAGEMENT: ENVIRONMENTAL RESEARCH ON HAZARDS					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of environmental research and development in your community?				
2.	Are you aware of environmental research on identification of hazards?				
3.	Has a mining company undertaken any environmental research on hazard management in your community?				
4.	Are there any projects on hazards undertaken by a mining company in your community interest?				
5.	Give an example(s) of a project on hazard undertaken by a mining company in your community. 5(a): ..... 5(b): .....				
6.	Is the project (please tick the appropriate box) 6(a): Long term? <input type="checkbox"/> Thi 6(b): Medium term? <input type="checkbox"/> Thi 6(c): Short term? <input type="checkbox"/> Thi 6(d): Other? <input type="checkbox"/> Thi				
7.	Are you satisfied with environmental research on hazard management in your community?				
8.	Are you interested to know about environmental research on hazard management in your community?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

STRATEGIC ENVIRONMENTAL MANAGEMENT: EQUIPMENT FOR HAZARD MANAGEMENT					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of a mining company purchasing new equipment in your community?				
2.	Are you aware of the type and purpose of the equipment bought by the mining company?				
3.	Has equipment been bought for hazard management in the community?				
4.	Is any information provided to your community on existing hazard equipment by mining companies?				
5.	Has the municipality informed your community about existing and new company equipment for hazard management?				
6.	Give two examples of new equipment bought by a mining company for hazard management. 6(a): ..... 6(b): .....				
7.	Has a mining company educated your community on the use and value of hazard equipment?				
8.	Are you interested to know/ obtain information from a mining company on hazard management?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

STRATEGIC ENVIRONMENTAL MANAGEMENT: MONITORING AND CONTROL SYSTEMS FOR HAZARDS					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of monitoring and control activities in your community?				
2.	Has a company ever informed your community about monitoring and control activities for hazards?				
3.	Give two examples of hazardous activities monitored in your community: 3(a): ..... 3(b): .....				
4.	Has your community been involved in any mining company monitoring and control activities for hazards?				
5.	Has the municipality ever taken part in community monitoring and control activities for hazards?				
6.	Has the municipality ever informed the public about the need for a mining company to monitor and control hazardous activities in communities?				
7.	Has your community been informed that mining is a hazard to the community in any form or way?				
8.	Are you interested to know about mining company monitoring and control of hazardous activities?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

STRATEGIC ENVIRONMENTAL MANAGEMENT: IMPROVE RISK AND AWARENESS PRACTICES					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the risk in mining as hazards?				
2.	Are you aware of possible mine hazard-related effects?				
3.	Are you informed of company efforts to improve risk and hazard-prone practices?				
4.	Is there a communication link between your community and a mining company on risks and hazards from mining?				
5.	Is there a communication link between your community and the State on risks and hazards from mining?				
6.	Has there been any project undertaken by a mining company on community risk and hazard prevention?				
7.	Is there any co-project undertaken by community, State and mining companies on risk and hazard management?				
8.	Are you interested to know more about mine risk and hazard management in your community?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: ENVIRONMENTAL LEGISLATION ON HAZARDS					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of environmental legislation in your community?				
2.	Are you aware of environmental legislation related to mine hazards in your community?				
3.	Has your community contributed to environmental legislation relating to hazards?				
4.	Has your community been educated on environmental legislation relating to hazards?				
5.	Is there a link between mining company and community participation in environmental legislation?				
6.	Is there a link between community and State participation in environmental legal aspects?				
7.	Is there a tripartite communication link between community, mining companies and municipality on environmental legislation?				
8.	What environmental legislation is known to your community? Name two. 8(a): ..... 8(b): .....				
9.	Are you interested to know about environmental hazards and environmental legislation in your community?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: NATIONAL ENVIRONMENTAL MANAGEMENT ACT, ACT NO. 107 OF 1998					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the National Environmental Management Act, Act No. 107 of 1998 requirements in your community?				
2.	Are you aware of the National Environmental Management Act compliance in your community?				
3.	Has a mining company ever informed your community about the National Environmental Management Act requirements / compliance?				
4.	Has the municipality ever informed your community about the National Environmental Management Act requirements / compliance?				
5.	Has there ever been a collective effort between the municipality, a mining company and the community on National Environmental Management Act compliance?				
6.	Do you see any need for a collective effort on National Environmental Management Act compliance?				
7.	Are you interested to know about mining company application of the National Environmental Management Act?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: ENVIRONMENT CONSERVATION ACT, ACT NO. 73 OF 1989					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the environment and conservation?				
2.	Are you aware of the Environment Conservation Act (Act No. 73 of 1989)?				
3.	Are you aware how a mining company implements the Environment Conservation Act in your community?				
4.	Has a mining company ever informed your community about Environment Conservation Act compliance?				
5.	Has the municipality ever informed your community about mining company Environment Conservation Act compliance?				
6.	Has there ever been a collective effort between the State, a mining company and the community in Environment Conservation Act compliance?				
7.	Do you see any need for such a collective effort on the Environment Conservation Act?				
8.	Are you interested to know about mining company Environment Conservation Act compliance?				
Comments:					



Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: MINERALS ACT, ACT NO. 50 OF 1991					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the Minerals Act (Act No. 50 of 1991) in your community?				
2.	Are you aware of mining company application of the Minerals Act?				
3.	Has a mining company ever informed your community about the application of the Minerals Act?				
4.	Has the municipality ever informed your community about the application of the Minerals Act?				
5.	Are you aware of the change of application of the Minerals Act (RSA, 1991)?				
6.	Has there ever been a joint effort between the municipality, a mining company and the community in the application of the Minerals Act or changes?				
7.	Are you interested to know about mining company application of the Mineral and Petroleum Resources Development Act?				
Comments:					





Name of Community \_\_\_\_\_

Name of Person \_\_\_\_\_

Position Held/Occupation \_\_\_\_\_

Age \_\_\_\_\_

Years of Residence \_\_\_\_\_

Date \_\_\_\_\_

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT NO. 28 OF 2002					
	Question	Yes	No	Sometimes	Other
1.	Are you aware of the Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 in your community?				
2.	Are you aware of any mining company application of the Mineral and Petroleum Resources Development Act in your community?				
3.	Are you aware of the change from the Minerals Act to the Mineral and Petroleum Resources Development Act?				
4.	Has a mining company ever informed your community about the application of the Mineral and Petroleum Resources Development Act?				
5.	Has the municipality ever informed your community about mining company application of the Mineral and Petroleum Resources Development Act?				
6.	Has there ever been a joint effort between the municipality, a mining company and the community on the application of the Mineral and Petroleum Resources Development Act?				
7.	Are you interested to know about company application of the Mineral and Petroleum Resources Development Act?				
Comments:					



## **Annexure 5: Total Responses per Question, Topic and Sub-topics, Given Scores with Values (Mean and Standard Deviation) and Voluntary Comments Categorised by Theme**

The total responses per question, topic and sub-topics, given scores with values (mean and standard deviation) and voluntary comments categorised by theme are presented in Tables 32 to 50 on the following pages.



**Table 32: (a) Individual responses and abstentions on dust exposure;  
(b) Voluntary comments on dust exposure categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	361	55	63	306	0.64	0.68	6	15	500
2	274	104	97	170	0.36	0.82	1	24	500
3	162	217	93	-55	-0.12	0.89	5	23	500
4	273	130	75	143	0.30	0.87	5	17	500
5	120	295	59	-175	-0.37	0.86	4	22	500
6	134	269	75	-135	-0.28	0.87	1	21	500
7	133	277	66	-144	-0.30	0.88	2	22	500
8	372	63	42	309	0.65	0.70	6	17	500
9	187	231	63	-44	-0.09	0.93	2	17	500
10	278	120	76	158	0.33	0.85	5	21	500

<b>b. Comments (n = 56)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
10	3	7	13	4	11	8
18 %	5 %	13 %	23 %	7 %	20 %	14 %

**Table 33: (a) Individual responses and abstentions on noise and vibration exposure;  
(b) Voluntary comments on noise and vibration exposure categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	328	84	76	244	0.50	0.77	2	10	500
2	318	72	98	246	0.50	0.74	2	10	500
3	204	122	144	82	0.17	0.81	3	27	500
4	111	299	74	-188	-0.39	0.83	5	11	500
5	124	285	73	-161	-0.33	0.86	6	12	500
6	125	264	95	-139	-0.29	0.85	6	10	500
7	278	118	75	160	0.34	0.85	5	24	500
8	269	121	93	148	0.31	0.84	4	13	500
9	371	75	37	296	0.61	0.74	7	10	500
<b>b. Comments (n = 43)</b>									
	<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>		
	7	4	0	12	1	10	9		
	16 %	9 %	0 %	29 %	2 %	23 %	21 %		

**Table 34: (a) Individual responses and abstentions on temperature and heat exposure;  
(b) Voluntary comments on temperature and heat exposure categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	280	113	78	167	0.35	0.84	19	0	490
2	243	102	126	141	0.30	0.80	10	9	490
3	91	302	71	-211	-0.45	0.80	14	12	490
4	119	260	102	-141	-0.29	0.84	8	1	490
5	149	247	69	-98	-0.21	0.90	14	11	490
6	241	137	67	104	0.23	0.89	29	16	490
7	273	115	65	158	0.35	0.86	28	9	490
8	383	45	38	338	0.73	0.63	16	8	490

<b>b. Comments (n = 43)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
4	6	1	6	2	15	9
9 %	14 %	2 %	14 %	5 %	35 %	21 %

**Table 35: (a) Individual responses and abstentions on coal-mining and coal-processing gases;  
 (b) Voluntary comments on coal-mining and coal-processing gases categorised per theme and as percentages;  
 (c) Responses to open-ended question on gases**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	316	92	45	224	0.49	0.81	10	37	500
2	0	0	0	0	0.00	0.00	0	0	0
3	147	272	60	-125	-0.26	0.90	4	17	500
4	139	252	82	-113	-0.24	0.88	3	24	500
5	171	198	80	-27	-0.06	0.90	10	41	500
6	271	126	70	145	0.31	0.87	15	18	500
7	276	135	53	141	0.30	0.89	10	26	500
8	245	133	88	112	0.24	0.87	10	24	500
9	266	122	72	144	0.31	0.86	15	25	500
10	100	332	44	-232	-0.49	0.82	9	15	500
11	352	69	33	283	0.62	0.73	13	33	500

<b>b. Comments (n = 26)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
2	2	1	7	2	5	7
8 %	8 %	4 %	26 %	8 %	19 %	27 %

<b>c. Gases known to the community</b>									
<b>Question No.</b>	<b>Carbon</b>	<b>Nitrogen</b>	<b>Hydrogen</b>	<b>Argon</b>	<b>Ozone</b>	<b>Sulphur</b>	<b>Oxygen</b>	<b>Wrong attempts</b>	<b>Total</b>
2	89	359	19	1	2	3	37	76	586

**Table 36: (a) Individual responses and abstentions on health and hazard exposure;  
 (b) Voluntary comments on health and hazard exposure categorised per theme and as percentages;  
 (c) Responses to open-ended questions (Questions 2, 4 and 6)**

a. Category responses									
Question No.	A Yes = +1	B No = -1	C Sometimes = 0	Total Score	Mean	±Std dev	D Other	E Abstain	Total =A+B+C+D+E
1	147	96	28	233	0.19	0.93	0	1	272
2	0	0	0	0	0	0	0	0	0
3	85	171	15	-86	-0.32	0.92	1	0	272
4	0	0	0	0	0	0	0	0	0
5	109	151	11	-42	-0.15	0.97	0	1	272
6	0	0	0	0	0	0	0	0	0
7	82	165	8	-83	-0.33	0.93	2	15	272
8	57	202	7	-145	-0.55	0.82	3	3	272
9	58	135	4	-77	-0.39	0.91	2	73	272
10	225	30	14	195	0.72	0.65	0	3	272

b. Comments (n = 18)						
Causes Harm	Causes Sickness	Asthma, TB and Other	Educate on Risk	Company, Municipality Negligence	Other	Information
0	1	0	3	1	9	4
0 %	6 %	0 %	17 %	6 %	49 %	22 %

**c. Knowledge-based responses on health and hazard exposure**

<b>Response</b>	<b>Question 2</b>	<b>Question 4</b>	<b>Question 6</b>
<b>Wrong attempt</b>	21	24	27
<b>Asthma</b>	7	6	0
<b>Sinusitis</b>	50	46	0
<b>Pneumoconiosis</b>	1	0	0
<b>Tuberculosis</b>	15	8	0
<b>Bronchitis</b>	5	4	0
<b>Cancer</b>	13	3	0
<b>Cousin</b>	0	0	9
<b>Neighbour</b>	0	0	5
<b>Uncle</b>	0	0	15
<b>Friend</b>	0	0	12
<b>Brother</b>	0	0	12
<b>Mother</b>	0	0	4
<b>Sister</b>	0	0	2
<b>Coughing blood</b>	1	6	0
<b>Itching nose</b>	0	1	0
<b>Class mate</b>	0	0	1
<b>I don't know</b>	3	0	0
<b>Bleeding</b>	0	2	0
<b>Father</b>	0	0	6
<b>Grandmother</b>	0	0	2
<b>Grandfather</b>	0	0	2
<b>Aunt</b>	0	0	2
<b>Daughter</b>	0	0	1



**Table 37: (a) Individual responses and abstentions on coal fires and fire-fighting equipment;  
(b) Voluntary comments on coal fires and fire-fighting equipment categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	364	58	39	306	0.66	0.69	10	5	476
2	245	131	69	114	0.26	0.88	15	16	476
3	171	177	103	-6	-0.01	0.88	18	7	476
4	155	194	101	-39	-0.09	0.88	22	4	476
5	115	172	70	-57	-0.16	0.88	8	111	476
6	124	250	88	-126	-0.27	0.86	7	7	476
7	150	219	95	-69	-0.15	0.88	6	6	476
8	371	57	30	314	0.69	0.68	14	4	476
9	374	41	42	333	0.73	0.61	15	4	476
10	282	79	91	203	0.45	0.77	22	2	476

<b>b. Voluntary comments (n = 41)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
3	0	0	12	6	8	12
7 %	0 %	0 %	29 %	15 %	20 %	29 %

**Table 38: (a) Individual responses and abstentions on air-quality monitoring;  
(b) Voluntary comments on air-quality monitoring categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	253	146	65	107	0.23	0.90	11	0	475
2	269	110	80	159	0.35	0.84	10	6	475
3	182	178	101	4	0.01	0.88	9	5	475
4	113	277	76	-164	-0.35	0.84	6	3	475
5	118	249	94	-131	-0.28	0.85	10	4	475
6	360	50	44	310	0.68	0.66	18	3	475
7	286	89	77	197	0.44	0.80	19	4	475

<b>b. Voluntary comments (n = 35)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
3	4	4	5	4	8	7
9 %	11 %	11 %	14 %	11 %	24 %	20 %

**Table 39: (a) Individual responses and abstentions on explosives and explosions;  
(b) Voluntary comments on explosives and explosions categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	259	114	58	145	0.34	1.03	12	2	445
2	208	145	67	63	0.15	0.97	22	3	445
3	99	264	63	-165	-0.39	1.29	15	4	445
4	111	238	77	-127	-0.30	1.19	15	4	445
5	185	179	62	6	0.01	0.99	19	0	445
6	313	59	54	254	0.60	1.51	18	1	445
7	344	49	38	295	0.68	1.77	13	1	445
8	234	102	77	132	0.32	1.07	30	2	445
<b>b. Voluntary comments (n = 35)</b>									
	<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>		
	6	1	0	6	3	8	11		
	17 %	3 %	0 %	17 %	9 %	23 %	31 %		

**Table 40: (a) Individual responses and abstentions on underground surveillance;  
(b) Voluntary comments on underground surveillance categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	220	158	79	62	0.14	0.90	10	3	470
2	240	131	83	109	0.24	0.87	9	7	470
3	125	251	81	-126	-0.28	0.86	6	7	470
4	128	235	97	-107	-0.23	0.86	8	2	470
5	333	57	60	276	0.61	0.70	16	4	470
6	270	88	82	182	0.41	0.80	23	7	470
7	252	90	90	162	0.38	0.81	29	9	470

<b>b. Voluntary comments (n = 27)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
8	1	0	3	1	7	7
29 %	4 %	0 %	11 %	4 %	26 %	26 %

**Table 41: (a) Individual responses and abstentions on environmental hazards and planning decisions;  
 (b) Voluntary comments on environmental hazards and planning decisions categorised per theme and as percentages;  
 (c) Responses to open-ended question on environmental hazards and planning decisions**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>± Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	196	52	33	144	0.51	0.79	2	0	283
2	72	174	36	-102	-0.36	0.86	0	1	283
3	46	166	56	-120	-0.45	0.77	7	8	283
5	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0
6	59	162	55	-103	-0.37	0.81	1	6	283
7	32	183	57	-151	-0.56	0.69	5	6	283
8	55	167	51	-112	-0.41	0.80	4	6	283
9	55	159	52	-104	-0.39	0.81	9	8	283
10	75	135	56	-60	-0.23	0.86	10	7	283
12	40	173	40	-133	-0.53	0.75	0	30	283

<b>b. Voluntary comments (n = 40)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
8	0	1	1	4	21	5
19 %	0 %	3 %	3 %	10 %	52 %	13 %

<b>c. Knowledge-based information broken down into various aspects</b>										
	<b>Question number</b>									
	<b>4a</b>	<b>4b</b>	<b>5a</b>	<b>5b</b>	<b>11a</b>	<b>11b</b>	<b>13a</b>	<b>13b</b>	<b>13c</b>	<b>13d</b>
<b>Employment</b>	0	0	0	0	1	1	25	4	0	0
<b>Education</b>	0	0	5	6	10	5	1	5	0	0
<b>Noise</b>	2	2	0	0	0	0	1	0	2	5
<b>Asthma</b>	0	1	0	0	0	0	0	0	0	3
<b>Unemployed</b>	0	0	0	0	0	0	3	0	0	2
<b>Dependents</b>	0	0	0	0	0	0	0	1	0	0
<b>Air pollution</b>	27	6	1	0	0	0	1	0	22	7
<b>Mine dumps</b>	1	0	0	0	0	0	0	0	0	0
<b>Sewage</b>	0	1	0	0	0	0	0	0	0	5
<b>Municipal Government</b>	0	0	1	0	0	0	0	1	0	0
<b>Collecting coal</b>	1	0	0	0	0	0	0	0	0	0
<b>Reduce pollution</b>	0	0	0	1	0	0	0	0	0	0
<b>Health check</b>	0	0	2	5	7	4	0	2	0	0
<b>Dust pollution</b>		2	0	0	0	0	0	0	1	0
<b>Earth trembling</b>	1	7	0	0	0	0	0	0	1	3
<b>Building schools</b>	0	0	0	0	8	0	1	2	1	0
<b>Provide facilities</b>	0	0	0	0	0	1	0	0	0	0
<b>Underground combustion</b>	3	3	0	0	0	0	0	0	0	0
<b>Disturbed the land</b>	0	1	0	0	0	0	0	0	0	1

	Question number									
	4a	4b	5a	5b	11a	11b	13a	13b	13c	13d
<b>Bad Environment</b>	0	0	0	0	0	0	0	0	3	0
<b>Water pollution</b>	0	6	0	0	0	0	0	0	4	3
<b>Relocate</b>	0	0	25	11	0	0	2	0	0	0
<b>Bursary</b>	0	0	0	0	2	8	0	1	0	0
<b>Cleanliness</b>	0	0	0	2	6	0	9	5	1	0
<b>Mining blast</b>	1	2	0	0	0	0	0	0	2	0
<b>Diseases</b>	1	5	0	0	0	0	1	1	11	1
<b>Awareness</b>	0	0	6	5	0	1	1	0	0	0
<b>Dust</b>	7	3	0	0	0	0	0	0	4	2
<b>Unpleasant</b>	0	0	0	0	0	0	0	0	1	0
<b>Dumping</b>	0	0	0	0	0	0	0	0	0	1
<b>Land pollution</b>	2	0	0	0	0	0	0	0	23	4
<b>Road</b>	0	0	1	0	3	1	4	1	1	0
<b>Smoke</b>	7	0	0	0	0	0	1	0	9	5
<b>Motivation</b>	0	0	0	0	0	0	0	1	0	0
<b>Poor housing</b>	1	0	0	0	0	0	0	0	2	1
<b>Electricity problem</b>	0	0	0	0	0	0	1	0	1	1
<b>Reduce production</b>	0	0	0	1	0	0	0	0	0	0
<b>Preventive measures</b>	0	0	17	5	0	0	0	0	0	0
<b>Car wash</b>	0	0	0	0	0	2	0	0	0	0
<b>Rehabilitate</b>	0	0	2	2	0	0	0	0	0	0
<b>Mine holes</b>	0	2	0	0	0	0	0	0	0	1
<b>No movement of chemicals</b>	0	0	1	1	0	0	0	0	0	0
<b>Compensation</b>	0	0	2	0	0	0	0	0	0	0
<b>Total</b>	54	41	64	40	37	23	51	24	89	45

**Table 42: (a) Individual responses and abstentions on environmental research on hazards;  
(b) Voluntary comments on environmental research on hazards categorised per theme and as percentages**

<b>a. Category responses</b>													
<b>Question No.</b>	<b>A</b>		<b>B</b>		<b>C</b>		<b>D</b>					<b>E</b>	
	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Wrong Response</b>	<b>Long term</b>	<b>Medium term</b>	<b>Short term</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	107	119	44	-12	-0.04	0.91	0	0	0	0	0	1	271
2	92	126	46	-34	-0.13	0.88	0	0	0	0	0	7	271
3	61	161	37	-100	-0.39	0.81	5	0	0	0	0	7	271
4	56	167	37	-111	-0.43	0.80	6	0	0	0	0	5	271
5a	0	161	0	-161	-1.00	0	0	25	0	0	0	85	271
5b	0	153	0	-153	-1.00	0	0	24	1	0	0	93	271
6	0	2	0	-2	-1.00	0	27	0	5	35	57	145	271
7	49	163	22	-114	-0.49	0.72	7	0	0	0	0	30	271
8	207	23	11	184	0.76	0.55	3	0	0	0	0	27	271

<b>b. Voluntary comments (n = 50)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
3	3	2	8	5	14	15
6 %	6 %	4 %	16 %	10 %	28 %	30 %



**Table 43: (a) Individual responses and abstentions on equipment for hazard management;  
(b) Voluntary comments on equipment for hazard management categorised per theme and as percentages**

<b>a. Category responses</b>										
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>		<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Wrong response</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	93	144	22	-51	-0.20	0.94	1	0	1	261
2	74	157	25	-83	-0.32	0.89	0	0	5	261
3	50	153	45	-103	-0.42	0.80	9	0	4	261
4	46	162	42	-116	-0.46	0.79	6	0	5	261
5	37	177	34	-140	-0.56	0.74	6	0	7	261
6a	0	0	0	0	0	0	0	153	108	261
6b	0	0	0	0	0	0	0	120	141	261
7	59	152	25	-93	-0.39	0.86	9	0	16	261
8	203	33	16	170	0.67	0.69	1	0	8	261

<b>b. Voluntary comments (n = 37)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
4	0	1	8	3	8	13
11 %	0 %	3 %	22 %	8 %	22 %	34 %

**Table 44:** (a) Individual responses on monitoring and control systems for hazards;  
 (b) Voluntary comments on monitoring and control systems for hazards categorised per theme and as percentages;  
 (c) Responses to open-ended questions, Questions 3a and b

a. Category responses									
Question No.	A	B	C	Total Score	Mean	±Std dev	D	E	Total = A+B+C+D+E
	Yes = +1	No = -1	Sometimes = 0						
1	86	114	34	-28	-0.12	0.92	0	4	238
2	44	145	37	-101	-0.45	0.80	6	6	238
3	0	0	0	0	0	0	0	0	0
4	62	140	26	-78	-0.34	0.88	6	4	238
5	51	134	37	-83	-0.37	0.83	5	11	238
6	58	128	42	-70	-0.31	0.85	5	5	238
7	82	116	29	-34	-0.15	0.92	3	8	238
8	180	38	16	142	0.61	0.75	0	4	238

b. Voluntary comments (n = 38)						
Causes Harm	Causes Sickness	Asthma, TB and Other	Educate on Risk	Company, Municipality Negligence	Other	Information
7	0	0	3	8	11	9
18 %	0 %	0 %	8 %	21 %	29 %	24 %

c. Knowledge-based responses												
Question No.	Wrong	Oxygen	Dumping	Pollution	Picking of papers	Warning zone	Fire	Coal burning	Water	Carbon	Abstain	Total
3a	136	1	1	13	0	0	1	0	0	2	84	238
3b	124	1	1	0	1	1	2	1	6	2	99	238

**Table 45: (a) Individual responses and abstentions on improve risk and awareness practices;  
(b) Voluntary comments on improve risk and awareness practices categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	157	53	22	104	0.45	0.84	0	2	234
2	131	65	33	66	0.29	0.88	1	4	234
3	49	146	34	-97	-0.42	0.82	1	4	234
4	57	128	39	-71	-0.32	0.85	2	8	234
5	64	119	43	-55	-0.24	0.87	3	5	234
6	37	136	41	-99	-0.46	0.77	6	14	234
7	52	137	32	-85	-0.38	0.84	9	4	234
8	182	37	13	145	0.63	0.74	1	1	234
<b>b. Voluntary comments (n = 31)</b>									
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>			
7	0	0	10	2	5	7			
23 %	0 %	0 %	32 %	6 %	16 %	23 %			

**Table 46: (a) Individual responses and abstentions on environmental legislation on hazards;  
(b) Voluntary comments on environmental legislation on hazards categorised per theme and as percentages**

<b>a. Category responses</b>										
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>		<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Wrong responses</b>	<b>Abstain</b>	<b>Total = A+B+C+D+E</b>
1	105	60	34	45	0.23	0.89	0	0	0	199
2	109	60	28	49	0.25	0.90	0	0	2	199
3	47	97	47	-50	-0.26	0.84	5	0	3	199
4	62	100	32	-38	-0.20	0.90	4	0	1	199
5	56	94	45	-38	-0.19	0.86	2	0	2	199
6	52	87	54	-35	-0.18	0.83	2	0	4	199
7	46	90	54	-44	-0.23	0.82	5	0	4	199
8a	0	0	0	0	0	0	0	78	121	199
8b	0	0	0	0	0	0	0	74	125	199
9	174	10	9	164	0.85	0.48	0	0	6	199

<b>b. Voluntary comments (n= 23)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
5	1	0	4	3	2	8
22 %	4 %	0 %	17 %	13 %	9 %	35 %

**Table 47: (a) Individual responses and abstentions on the National Environmental Management Act (RSA 1998); (b) Voluntary comments on the National Environmental Management Act categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	75	156	44	-81	-0.29	0.87	1	1	277
2	62	172	40	-110	-0.40	0.83	1	2	277
3	53	175	48	-122	-0.44	0.79	1	0	277
4	58	165	47	-107	-0.40	0.82	2	5	277
5	47	162	64	-115	-0.42	0.77	2	2	277
6	162	76	35	86	0.32	0.88	0	4	277
7	237	22	18	215	0.78	0.58	0	0	277

<b>b. Voluntary comments (n = 28)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
2	0	0	3	3	5	15
7 %	0 %	0 %	11 %	11 %	18 %	53 %

**Table 48: (a) Individual responses and abstentions on the Environment Conservation Act (RSA 1989);  
(b) Voluntary comments on the Environment Conservation Act categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	162	76	37	86	0.31	1.14	0	0	275
2	100	125	47	-25	-0.09	1.49	0	3	275
3	63	144	62	-81	-0.30	1.70	1	5	275
4	55	184	32	-129	-0.48	1.80	1	3	275
5	55	156	60	-101	-0.37	1.78	1	3	275
6	57	157	55	-100	-0.37	1.76	4	2	275
7	177	61	34	116	0.43	1.03	0	3	275
8	220	27	27	193	0.70	0.71	0	1	275

<b>b. Voluntary comments (n = 19)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
0	0	0	1	4	9	5
0 %	0 %	0 %	5 %	21 %	48 %	26 %

**Table 49: (a) Individual responses and abstentions on the Minerals Act (RSA 1991);  
(b) Voluntary comments on the Minerals Act categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	177	97	40	80	0.25	0.90	3	3	320
2	125	153	38	-28	-0.09	0.93	1	3	320
3	75	196	41	-121	-0.39	0.85	3	5	320
4	67	183	57	-116	-0.38	0.82	5	8	320
5	102	175	39	-73	-0.23	0.91	1	3	320
6	75	185	49	-110	-0.36	0.85	8	3	320
7	245	51	22	194	0.61	0.75	1	1	320
<b>b. Voluntary comments (n = 30)</b>									
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>			
3	3	0	0	9	8	7			
10 %	10 %	0 %	0 %	30 %	27 %	23 %			

**Table 50: (a) Individual responses and abstentions on the Mineral and Petroleum Resources Development Act (RSA 2002); (b) Voluntary comments on the Mineral and Petroleum Resources Development Act categorised per theme and as percentages**

<b>a. Category responses</b>									
	<b>A</b>	<b>B</b>	<b>C</b>				<b>D</b>	<b>E</b>	
<b>Question No.</b>	<b>Yes = +1</b>	<b>No = -1</b>	<b>Sometimes = 0</b>	<b>Total Score</b>	<b>Mean</b>	<b>±Std dev</b>	<b>Other</b>	<b>Abstain</b>	<b>Total =A+B+C+D+E</b>
1	106	153	38	-47	-0.16	0.92	6	1	304
2	79	184	36	-105	-0.35	0.87	3	2	304
3	78	167	52	-89	-0.30	0.86	5	2	304
4	69	185	42	-116	-0.39	0.84	7	1	304
5	62	190	25	-128	-0.46	0.83	6	21	304
6	67	175	54	-108	-0.36	0.83	7	1	304
7	135	49	18	86	0.43	0.85	2	100	304

<b>b. Voluntary comments (n= 28)</b>						
<b>Causes Harm</b>	<b>Causes Sickness</b>	<b>Asthma, TB and Other</b>	<b>Educate on Risk</b>	<b>Company, Municipality Negligence</b>	<b>Other</b>	<b>Information</b>
2	0	0	2	1	14	9
7 %	0 %	0 %	7 %	4 %	50 %	32 %



## **Annexure 6: Total Responses per Questionnaire and Equivalent Percentages**

The total responses per questionnaire and their equivalent percentages are included on the following pages



### HEALTH AND SAFETY: DUST EXPOSURE

Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	361	72	55	11	63	13	6	1	15	3	500
2	274	55	104	21	97	19	1	0	24	5	500
3	162	32	217	43	93	19	5	1	23	5	500
4	273	55	130	26	75	15	5	1	17	3	500
5	120	24	295	59	59	11	4	1	22	4	500
6	134	27	269	54	75	15	1	0	21	4	500
7	133	27	277	55	66	13	2	0	22	4	500
8	372	74	63	13	42	8	6	1	17	3	500
9	187	37	231	46	63	13	2	0	17	3	500
10	278	56	120	24	76	15	5	1	21	4	500
11	Comments = 56										

### HEALTH AND SAFETY: NOISE AND VIBRATION EXPOSURE

Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	328	66	84	17	76	15	2	0	10	2	500
2	318	64	72	14	98	20	2	0	10	2	500
3	204	41	122	24	144	29	3	1	27	5	500
4	111	22	299	60	74	15	5	1	11	2	500
5	124	25	285	57	73	15	6	1	12	2	500
6	125	25	264	53	95	19	6	1	10	2	500
7	278	56	118	24	75	15	5	1	24	5	500
8	269	54	121	24	93	19	4	1	13	3	500
9	371	74	75	15	37	7	7	1	10	2	500
10	Comments = 43										

<b>HEALTH AND SAFETY: TEMPERATURE AND HEAT EXPOSURE</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
<b>1</b>	280	57	113	23	78	16	19	4	0	0	490
<b>2</b>	243	50	102	21	126	26	10	2	9	2	490
<b>3</b>	91	19	302	62	71	14	14	3	12	2	490
<b>4</b>	119	24	260	53	102	21	8	2	1	0	490
<b>5</b>	149	30	247	50	69	14	14	3	11	2	490
<b>6</b>	241	49	137	28	67	14	29	6	16	3	490
<b>7</b>	273	56	115	23	65	13	28	6	9	2	490
<b>8</b>	383	78	45	9	38	8	16	3	8	2	490
<b>9</b>	Comments = 43										

<b>HEALTH AND SAFETY: COAL-MINING AND COAL-PROCESSING GASES</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
<b>1</b>	316	63	92	18	45	9	10	2	37	7	500
<b>3</b>	147	29	272	54	60	12	4	1	17	3	500
<b>4</b>	139	28	252	50	82	16	3	1	24	5	500
<b>5</b>	171	34	198	40	80	16	10	2	41	8	500
<b>6</b>	271	54	126	25	70	14	15	3	18	4	500
<b>7</b>	276	55	135	27	53	11	10	2	26	5	500
<b>8</b>	245	49	133	27	88	18	10	2	24	5	500
<b>9</b>	266	53	122	24	72	14	15	3	25	5	500
<b>10</b>	100	20	332	66	44	9	9	2	15	3	500
<b>11</b>	352	70	69	14	33	7	13	3	33	7	500
<b>12</b>	Comments = 26										

<b>HEALTH AND SAFETY: HEALTH AND HAZARD EXPOSURE</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
<b>1</b>	14	54	96	35	28	10	0	0	1	0	272
<b>3</b>	85	31	171	63	15	6	1	1	0	0	272
<b>5</b>	109	40	151	56	11	4	0	0	1	0	272
<b>7</b>	82	30	165	61	8	3	2	1	15	6	272
<b>8</b>	57	21	202	74	7	3	3	1	3	1	272
<b>9</b>	58	21	135	50	4	1	2	1	73	27	272
<b>10</b>	225	83	30	11	14	5	0	0	3	1	272
<b>11</b>	Comments = 18										



<b>DISASTER PREPAREDNESS AND AWARENESS RESPONSE: COAL FIRES AND FIRE-FIGHTING EQUIPMENT</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
<b>1</b>	364	76	58	12	39	8	10	2	5	1	476
<b>2</b>	245	51	131	28	69	14	15	3	16	3	476
<b>3</b>	171	36	177	37	103	22	18	4	7	1	476
<b>4</b>	155	33	194	41	101	21	22	5	4	1	476
<b>5</b>	115	24	172	36	70	15	8	2	111	23	476
<b>6</b>	124	26	250	53	88	18	7	1	7	1	476
<b>7</b>	150	32	219	46	95	20	6	1	6	1	476
<b>8</b>	371	78	57	12	30	6	14	3	4	1	476
<b>9</b>	374	79	41	9	42	9	15	3	4	1	476
<b>10</b>	282	59	79	16	91	19	22	5	2	0	476
<b>11</b>	Comments = 41										

<b>DISASTER PREPAREDNESS AND AWARENESS RESPONSE: AIR-QUALITY MONITORING</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
<b>1</b>	253	53	146	30	65	14	11	2	0	0	475
<b>2</b>	269	57	110	23	80	17	10	2	6	1	475
<b>3</b>	182	38	178	37	101	21	9	2	5	1	475
<b>4</b>	113	24	277	58	76	16	6	1	3	1	475
<b>5</b>	118	25	249	52	94	20	10	2	4	1	475
<b>6</b>	360	76	50	11	44	9	18	4	3	1	475
<b>7</b>	286	60	89	19	77	16	19	4	4	1	475
<b>8</b>	Comments = 35										

**DISASTER PREPAREDNESS AND AWARENESS RESPONSE: EXPLOSIVES AND EXPLOSIONS**

Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	259	58	114	26	58	13	12	3	2	0	445
2	208	47	145	33	67	15	22	5	3	1	445
3	99	22	264	59	63	14	15	3	4	1	445
4	111	25	238	53	77	17	15	3	4	1	445
5	185	42	179	40	62	14	19	4	0	0	445
6	313	70	59	13	54	12	18	4	1	0	445
7	344	77	49	11	38	9	13	3	1	0	445
8	234	53	102	23	77	17	30	7	2	0	445
9	Comments = 35										

**DISASTER PREPAREDNESS AND AWARENESS RESPONSE: UNDERGROUND SURVEILLANCE**

Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	220	47	158	34	79	17	10	2	3	1	470
2	240	51	131	28	83	18	9	2	7	1	470
3	125	27	251	53	81	17	6	1	7	1	470
4	128	27	235	50	97	21	8	2	2	0	470
5	333	71	57	12	60	13	16	3	4	1	470
6	270	57	88	19	82	17	23	5	7	1	470
7	252	54	90	19	90	19	29	6	9	2	470
8	Comments = 27										

STRATEGIC ENVIRONMENTAL MANAGEMENT: ENVIRONMENTAL HAZARDS AND PLANNING DECISIONS											
Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	196	69	52	18	33	12	2	1	0	0	283
2	72	25	174	61	36	13	0	0	1	0	283
3	46	16	166	59	56	20	7	2	8	3	283
6	59	21	162	57	55	19	1	0	6	2	283
7	32	11	183	65	57	20	5	2	6	2	283
8	55	19	167	59	51	18	4	1	6	2	283
9	55	19	159	56	52	18	9	3	8	3	283
10	75	27	135	48	56	20	10	4	7	2	283
12	40	14	173	61	40	14	0	0	30	11	283
	Comments = 40										

STRATEGIC ENVIRONMENTAL MANAGEMENT: ENVIRONMENTAL RESEARCH ON HAZARDS																			
Question	Yes	%	No	%	Sometimes	%	Other	%	Wrong re-sponse	%	Long term	%	Medium term	%	Short term	%	Abstain	%	Total
1	107	39	119	44	44	16	0	0	0	0	0	0	0	0	0	0	1	0	271
2	92	34	126	46	46	17	0	0	0	0	0	0	0	0	0	0	7	3	271
3	61	23	161	59	37	14	5	2	0	0	0	0	0	0	0	0	7	3	271
4	56	21	167	62	37	14	6	2	0	0	0	0	0	0	0	0	5	2	271
5a	0	0	161	59	0	0	0	0	24	9	0	0	0	0	0	0	85	31	271
5b	0	0	153	56	0	0	0	0	24	9	1	0	0	0	0	0	93	34	271
6	0	0	2	1	0	0	27	10	0	0	5	2	35	13	57	21	145	54	271
7	49	18	163	60	22	8	7	3	0	0	0	0	0	0	0	0	30	11	271
8	207	76	23	8	11	11	3	1	0	0	0	0	0	0	0	0	27	10	271
9	Comments = 50																		

**STRATEGIC ENVIRONMENTAL MANAGEMENT: EQUIPMENT FOR HAZARD MANAGEMENT**

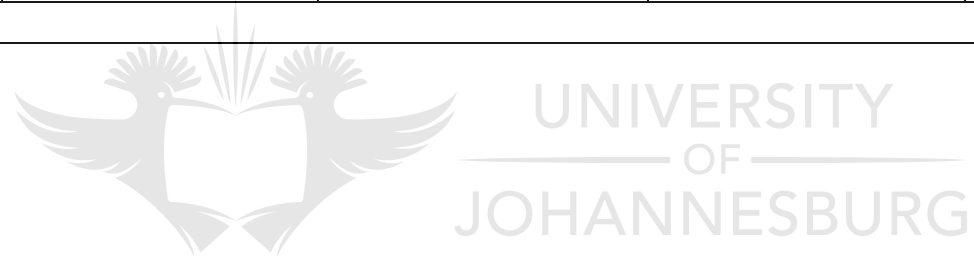
Question	Yes	%	No	%	Some-times	%	Other	%	Wrong response	%	Abstain	%	Total
1	93	36	144	55	22	8	1	0	0	0	1	0	261
2	74	28	157	60	25	10	0	0	0	0	5	2	261
3	50	19	153	59	45	17	9	3	0	0	4	1	261
4	46	18	162	62	42	16	6	2	0	0	5	2	261
5	37	14	177	68	34	13	6	2	0	0	7	3	261
6a	0	0	0	0	0	0	0	0	153	59	108	41	261
6b	0	0	0	0	0	0	0	0	120	46	141	54	261
7	59	23	152	58	25	10	9	3	0	0	16	6	261
8	203	78	33	13	16	6	1	0	0	0	8	3	261
9	Comments = 37												

**STRATEGIC ENVIRONMENTAL MANAGEMENT: MONITORING AND CONTROL SYSTEMS FOR HAZARDS**

Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	86	36	114	48	34	14	0	0	4	2	238
2	44	18	145	61	37	16	6	3	6	3	238
4	62	26	140	59	26	11	6	3	4	2	238
5	51	21	134	56	37	16	5	2	11	5	238
6	58	24	128	54	42	18	5	2	5	2	238
7	82	34	116	49	29	12	3	1	8	3	238
8	180	76	38	16	16	7	0	0	42	18	238
9	Comments = 38										



STRATEGIC ENVIRONMENTAL MANAGEMENT: IMPROVE RISK AND AWARENESS PRACTICES											
Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	157	67	53	23	22	9	0	0	2	1	234
2	131	56	65	28	33	14	1	0	4	2	234
3	49	21	146	62	34	15	1	0	4	2	234
4	57	24	128	55	39	17	2	1	8	3	234
5	64	27	119	51	43	18	3	1	5	2	234
6	37	16	136	58	41	18	6	3	14	6	234
7	52	22	137	59	32	14	9	4	4	2	234
8	182	78	37	16	13	6	1	0	1	0	234
9	Comments = 31										



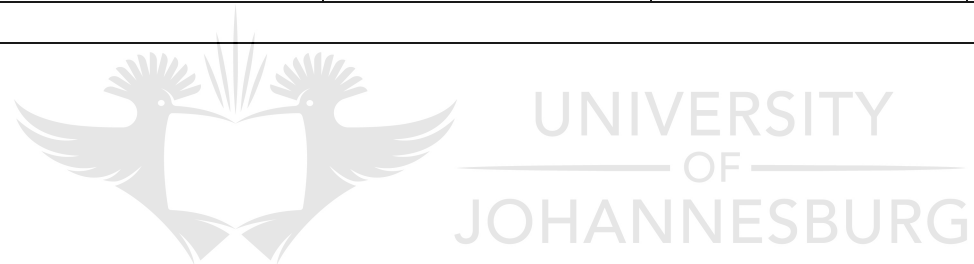
ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: ENVIRONMENTAL LEGISLATION ON HAZARDS													
Question	Yes	%	No	%	Sometimes	%	Other	%	Wrong response	%	Abstain	%	Total
1	105	53	60	30	34	17	0	0	0	0	0	0	199
2	109	55	60	30	28	14	0	0	0	0	2	1	199
3	47	24	97	49	47	24	5	3	0	0	3	2	199
4	62	31	100	50	32	16	4	2	0	0	1	0	199
5	56	28	94	47	45	23	2	1	0	0	2	1	199
6	52	26	87	44	54	27	2	1	0	0	4	2	199
7	46	23	90	45	54	27	5	3	0	0	4	2	199
8a	0	0	0	0	0	0	0	0	78	39	121	61	199
8b	0	0	0	0	0	0	0	0	74	37	125	63	199
9	174	87	10	5	9	4	0	0	0	0	6	3	199
10	Comments = 23												

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: NATIONAL ENVIRONMENTAL MANAGEMENT ACT (RSA 1998)												
Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total	
1	75	27	156	56	44	16	1	0	1	0	277	
2	62	22	172	62	40	14	1	0	2	1	277	
3	53	19	175	63	48	17	1	0	0	0	277	
4	58	21	165	50	47	17	2	1	5	2	277	
5	47	17	162	58	64	23	2	1	2	1	277	
6	162	58	76	27	35	13	0	0	4	2	277	
7	237	86	22	8	18	6	0	0	0	0	277	
8	Comments = 28											

<b>ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: ENVIRONMENT CONSERVATION ACT (RSA 1989)</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
1	162	59	76	28	37	13	0	0	0	0	275
2	100	36	125	45	47	17	0	0	3	1	275
3	63	23	144	52	62	23	1	0	5	2	275
4	55	20	184	67	32	12	1	0	3	1	275
5	55	20	156	57	60	22	1	0	3	1	275
6	57	21	157	57	55	20	4	1	2	0	275
7	177	64	61	22	34	12	0	0	3	1	275
8	220	80	27	10	27	10	0	0	1	0	275
9	Comments = 19										

<b>ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: MINERALS ACT (RSA 1991)</b>											
<b>Question</b>	<b>Yes</b>	<b>%</b>	<b>No</b>	<b>%</b>	<b>Sometimes</b>	<b>%</b>	<b>Other</b>	<b>%</b>	<b>Abstain</b>	<b>%</b>	<b>Total</b>
1	177	55	97	30	40	13	3	1	3	1	320
2	125	39	153	48	38	12	1	0	3	1	320
3	75	23	196	61	41	13	3	1	5	2	320
4	67	21	183	57	57	18	5	2	8	3	320
5	102	32	175	55	39	12	1	0	3	1	320
6	75	23	185	58	49	15	8	3	3	1	320
7	245	77	51	16	22	7	1	0	1	0	320
8	Comments = 30										

ENVIRONMENTAL LEGAL APPLICATION AND COMPLIANCE: MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (RSA 2002)											
Question	Yes	%	No	%	Sometimes	%	Other	%	Abstain	%	Total
1	106	35	153	50	38	13	6	2	1	0	304
2	79	26	184	61	36	12	3	1	2	1	304
3	78	26	167	55	52	17	5	2	2	1	304
4	69	23	185	61	42	14	7	2	1	0	304
5	62	20	190	63	25	8	6	2	21	7	304
6	67	22	175	58	54	18	7	2	1	0	304
7	135	44	49	16	18	6	2	1	100	32	304
8	Comments = 28										



## **Annexure 7: Total Structured Questions Grouped by Topic Using a t-test for Variance**

The total structured questions grouped by topic, using a t-test for variance, are presented on the following pages.



### HEALTH and SAFETY

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>A</b>	<b>Awareness on health and safety</b>									
1	Are you aware of dust coming from mines?	2.48	2.58	-1.07	No	160	6	26	73	2.53
2	Are you aware of dust within the community attributed to mining activities?	2.30	1.77	4.66	Yes	160	6	26	73	2.09
3	Are you aware whether any mining company carries out dust control within the mining community?	1.56	1.77	-1.91	No	160	6	26	73	1.64
4	Are you aware of the hazards of coal-dust exposure?	2.28	2.18	0.75	No	160	6	26	73	2.24
5	Are you aware of the hazards of noise and vibration?	2.47	2.52	-0.75	No	305	31	46	108	2.49
6	Are you aware of temperature and heat as hazards?	2.19	2.36	-2.00	No	315	25	54	90	2.25
7	Are you aware of gases generated during coal-mining and coal-processing operations?	2.31	2.34	-0.26	No	352	13	44	77	2.32
8	Are you aware about the hazards of coal-mining and coal-processing gases?	2.26	2.10	1.53	No	352	13	44	77	2.22
9	Are you aware of any coal-related health hazards?	2.24	2.06	1.48	No	184	13	52	23	2.18
	<b>Average</b>	<b>2.23</b>	<b>2.19</b>	<b>0.27</b>						<b>2.22</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>B</b>	<b>Information received via education</b>									
1	Has any mining company ever educated your community on the hazards of coal dust?	1.57	1.53	0.32	No	160	6	26	73	1.55
2	Has the municipality ever educated your community on the hazards of coal dust?	1.33	1.31	0.13	No	160	6	26	73	1.32
3	Has a mining company ever educated your community about the hazards of noise and vibration from mines?	1.58	1.61	-0.27	No	305	31	46	108	1.59
4	Has the municipality ever educated your community about the hazards of noise and vibration from mines?	1.67	1.59	0.87	No	305	31	46	108	1.64
5	Has a mining company ever educated your community on the hazards of temperature and heat exposure?	1.49	1.47	0.15	No	315	25	54	90	1.48
6	Has the municipality ever educated your community on the hazards of temperature and heat exposure?	1.70	1.64	0.67	No	315	25	54	90	1.68
7	Has a mining company ever educated your community about the existence of various coal-mining and coal-processing gases?	1.74	1.64	0.97	No	352	13	44	77	1.71
8	Has the municipality ever educated your community about the existence of various coal-mining and coal-processing gases?	1.73	1.65	0.88	No	352	13	44	77	1.71
	<b>Average</b>	<b>1.60</b>	<b>1.56</b>	<b>0.47</b>						<b>1.59</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>C</b>	<b>Information received via industry or local government</b>									
1	Are there any reports or information provided to your community on dust control by a mining company?	1.61	1.73	-1.10	No	160	6	26	73	1.66
2	Is there any clinical survey/report done on dust-related diseases within your community?	2.04	1.88	1.44	No	160	6	26	73	1.98
3	Are the workers informed about coal dust and related diseases from coal dust?	2.28	2.26	0.20	No	160	6	26	73	2.27
4	Has information ever been provided to the community on the hazards of noise and vibration from mines?	1.67	1.59	0.87	No	305	31	46	108	1.64
5	Are you aware whether mine workers are informed of the hazards of noise and vibration during mining?	1.75	1.60	1.84	No	305	31	46	108	1.69
6	Has information ever been provided to communities on the hazards of temperature and heat exposure?	2.29	2.24	0.49	No	315	25	54	90	2.27
7	Are you aware whether mine workers are informed about the hazards of temperature and heat exposure?	1.74	1.72	0.20	No	315	25	54	90	1.73
8	Are you aware whether mine workers are tested for temperature and heat-related diseases?	2.00	2.16	-1.60	No	315	25	54	90	2.06
9	Has information been provided to your community about the existence of coal-mining and coal-processing gases?	2.19	2.22	-0.30	No	352	13	44	77	2.20



Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
10	Are you aware whether mine workers are informed about the various coal-mining and coal-processing gases?	2.24	2.08	1.52	No	352	13	44	77	2.20
11	Are you aware whether mine workers are informed about the hazards of the various coal-mining and coal-processing gases?	2.19	2.02	1.66	No	352	13	44	77	2.14
	<b>Average</b>	<b>2.00</b>	<b>1.96</b>	<b>0.47</b>						<b>1.99</b>



Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>D</b>	<b>Interest to acquire knowledge</b>									
1	Are you interested to know about coal-dust control by a mining company?	2.41	2.53	-1.11	No	160	6	26	73	2.46
2	Do you sometimes hear the noise from company mining activities?	2.50	2.49	0.04	No	305	31	46	108	2.49
3	Are you interested to know about mining company noise and vibration control measures?	2.62	2.51	1.41	No	305	31	46	108	2.58
4	Are you interested to know about mining company temperature and heat control measures?	2.62	2.64	-0.30	No	315	25	54	90	2.63
5	Are you interested to know how a mining company manages the various coal-mining and coal-processing gases?	2.52	2.47	0.62	No	352	13	44	77	2.51
6	Are you interested to know about the health hazards of coal and related illnesses?	1.57	1.90	-2.34	No	184	13	52	23	1.68
	<b>Average</b>	<b>2.37</b>	<b>2.42</b>	<b>-0.28</b>	<b>No</b>					<b>2.39</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Un-employed	
<b>E</b>	<b>Indirect evaluation of awareness derived through workers in industry</b>									
1	Are you aware whether mine workers are sometimes tested for noise and vibration-related diseases?	2.30	2.23	0.80	No	305	31	46	108	2.27
2	Are you aware whether mine workers are tested for various coal-mining and coal-processing gas-related diseases?	2.22	2.08	1.40	No	352	13	44	77	2.19
3	Have you been tested for any coal-mining and coal-processing gas-related diseases?	1.46	1.52	-0.64	No	352	13	44	77	1.48
4	Have you suffered from any coal-related illness?	1.82	1.39	3.97	Yes	184	13	52	23	1.68
5	Do you know anyone who has suffered from a coal-related disease?	1.86	1.77	0.67	No	184	13	52	23	1.83
6	Has he/she ever worked at a coal-mining company?	1.71	1.28	3.65	Yes	184	13	52	23	1.57
7	Do you know anyone who has died from a coal-mining related disease?	1.51	1.26	2.53	No	184	13	52	23	1.43
	<b>Average</b>	<b>1.84</b>	<b>1.65</b>	<b>1.77</b>						<b>1.78</b>
<b>F</b>	<b>Information via personal observation</b>									
1	Is the noise intrusive (loud) and obstructive to hearing?	2.01	2.20	-2.32	No	305	31	46	108	2.08
2	Do you sometimes feel an abnormal temperature and heat increase likely as a result of mining processes?	2.22	2.28	-0.74	No	305	31	46	108	2.24
	<b>Average</b>	<b>2.11</b>	<b>2.24</b>	<b>-1.53</b>						<b>2.16</b>

**DISASTER PREPAREDNESS and AWARENESS RESPONSE**

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>A</b>	<b>Awareness on disaster preparedness measures and awareness response</b>									
1	Are you aware of coal fires within your community?	2.58	2.58	-0.03	No	265	12	58	140	2.58
2	Are you aware of the hazard of coal fires in your community?	2.21	2.08	1.49	No	265	12	58	140	2.15
3	Are you aware of mining company fire-fighting efforts in your community?	1.90	1.86	0.42	No	265	12	58	140	1.88
4	Are you aware of mining company fire-fighting equipment within your community?	1.77	1.86	-1.08	No	265	12	58	140	1.81
5	Are you aware of the value of good quality air?	2.15	2.23	-0.93	No	303	11	40	121	2.18
6	Are you aware of the hazards of bad air?	2.28	2.25	0.30	No	303	11	40	121	2.27
7	Are you aware of mining company air-quality monitoring?	1.96	1.93	0.34	No	303	11	40	121	1.95
8	Are you aware of explosives?	2.22	2.30	-0.87	No	227	21	63	133	2.26
9	Are you aware of the use of explosives during coal mining?	1.99	2.07	-0.90	No	227	21	63	133	2.03
10	Are you aware of the hazards associated with the explosives?	1.92	1.93	-0.16	No	227	21	63	133	1.92
11	Are you aware of company surveillance on mines?	2.04	2.13	-0.98	No	274	31	40	125	2.08
12	Are you aware of company underground surveillance in mines?	2.15	2.19	-0.49	No	274	31	40	125	2.16
	<b>Average</b>	<b>2.10</b>	<b>2.12</b>	<b>-0.24</b>						<b>2.11</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>B</b>	<b>Information received via industry or local government</b>									
1	Has a mining company ever informed your community about fire-fighting efforts?	1.86	1.50	4.12	Yes	265	12	58	140	1.70
2	Has the municipality ever informed your community about mining company fire-fighting efforts?	1.65	1.71	-0.82	No	265	12	58	140	1.68
3	Has a mining company ever informed your community about the hazards of coal fires?	1.82	1.78	0.50	No	265	12	58	140	1.80
4	Has a mining company ever informed the community about the value of air-quality monitoring?	1.65	1.56	1.01	No	303	11	40	121	1.62
5	Has the municipality ever informed the community about the value of air-quality monitoring?	1.62	1.74	-1.35	No	303	11	40	121	1.67
6	Has a mining company informed your community about the use of explosives in mines?	1.52	1.57	-0.58	No	227		63	133	1.54
7	Has the municipality ever informed your community about company use of explosives in mines?	1.63	1.63	-0.09	No	227	21	63	133	1.63
8	Has a mining company ever informed your community about underground surveillance on mines?	1.61	1.78	-2.01	No	274	31	40	125	1.68
9	Has the municipality ever informed your community about a mining company underground surveillance?	1.69	1.78	-1.04	No	274	31	40	125	1.73
	<b>Average</b>	<b>1.67</b>	<b>1.67</b>	<b>-0.03</b>						<b>1.67</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>C</b>	<b>Interest to acquire knowledge</b>									
1	Are you interested to know about the hazards of coal fires?	2.72	2.41	3.94	Yes	265	12	58	140	2.58
2	Are you interested to know how a mining company combats coal fires?	2.72	2.41	3.94	Yes	265	12	58	140	2.58
3	Are you interested to know about mining company air-quality monitoring?	2.68	2.36	3.75	Yes	303	11	40	121	2.56
4	Are you interested to know about the hazards of explosives?	2.53	2.44	1.17	No	227	21	63	133	2.49
5	Are you interested to know how a mining company protects the community from the hazards arising from the use of mine explosives?	2.69	2.50	2.45	No	227	21	63	133	2.60
6	Are you interested to know about company underground surveillance?	2.52	2.48	0.49	No	274	31	40	125	2.50
	<b>Average</b>	<b>2.63</b>	<b>2.44</b>	<b>2.36</b>						<b>2.55</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>D</b>	<b>Indirect evaluation of awareness derived through workers in industry</b>									
1	Are the workers from your community aware of the hazards of coal fires?	2.29	2.38	-1.06	No	265	12	58	140	2.33
2	Are the workers from your community aware of the hazards of coal-mining and coal-processing on air quality?	2.27	2.39	-1.35	No	303	11	40	121	2.31
3	Are the workers from your community aware of the hazards of mine explosives?	2.09	2.22	-1.38	No	227	21	63	133	2.15
4	Are the workers from your community aware of mining company underground surveillance?	2.18	2.37	-2.17	No	274	31	40	125	2.26
5	Are the workers from your community aware of the need for company underground surveillance?	2.17	2.20	-0.30	No	274	31	40	125	2.18
	<b>Average</b>	<b>2.20</b>	<b>2.31</b>	<b>-1.25</b>						<b>2.25</b>

**STRATEGIC ENVIRONMENTAL MANAGEMENT DECISIONS/PLANNING**

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>A</b>	<b>Awareness on strategic environmental management decisions/planning</b>									
1	Are you aware of mining hazards that surround your community?	2.57	2.38	1.89	No	172	6	79	26	2.49
2	Are you aware of company environmental decisions/planning in hazard management?	1.69	1.55	1.31	No	172	6	79	26	1.63
3	Are you aware of environmental research and development in your community?	2.14	1.76	3.48	Yes	133	16	79	43	1.95
4	Are you aware of environmental research on identification of hazards?	2.02	1.64	3.38	Yes	133	16	79	43	1.82
5	Are you aware of a mining company purchasing new equipment in your community?	1.98	1.60	3.38	Yes	130	10	82	38	1.79
6	Are you aware of the type and purpose of the equipment bought by the mining company?	1.79	1.56	2.14	No	130	10	82	38	1.67
7	Are you aware of monitoring and control activities in your community?	2.09	1.59	4.20	Yes	122	10	79	27	1.85
8	Are you aware of the risk in mining as hazards?	2.56	2.32	2.19	No	105	23	74	32	2.43
9	Are you aware of possible mine hazard-related effects?	2.30	2.19	0.97	No	105	23	74	32	2.24
	<b>Average</b>	<b>2.13</b>	<b>1.84</b>	<b>2.55</b>						<b>1.99</b>



Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>B</b>	<b>Information received via education</b>									
1	Has a mining company educated your community on the use and value of hazard equipment?	1.56	1.34	1.87	No	130	10	82	38	1.45
<b>C</b>	<b>Information received via industry or local government</b>									
1	Has a mining company informed your community about environmental hazard decisions and planning?	1.44	1.32	1.39	No	172	6	76	26	1.39
2	Is any information provided to your community on existing hazard equipment by mining companies?	1.62	1.32	2.99	No	133	16	79	43	1.47
3	Has the municipality informed your community about existing and new company equipment for hazard management?	1.51	1.22	2.99	No	133	16	79	43	1.36
4	Has a company ever informed your community about monitoring and control activities for hazards?	1.77	1.16	5.92	Yes	130	10	82	38	1.47
5	Has the municipality ever informed the public about the need for a mining company to monitor and control hazardous activities in communities?	1.85	1.39	4.08	Yes	122	10	79	27	1.62
6	Has your community been informed that mining is a hazard to the community in any form or way?	2.05	1.46	4.89	Yes	122	10	79	27	1.76
7	Are you informed of company efforts to improve risk and hazard-prone practices?	1.78	1.35	3.93	Yes	105	23	74	32	1.54
	<b>Average</b>	<b>1.72</b>	<b>1.32</b>	<b>3.74</b>						<b>1.52</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>D</b>	<b>Communication link</b>									
1	Is there a communication link between your community and a mining company?	1.69	1.43	2.60	No	172	6	79	26	1.59
2	Is there a communication link between your community and a mining company on risks and hazards from mining?	1.79	1.49	2.28	No	105	23	74	32	1.61
3	Is there a communication link between your community and the State on risk and hazards from mining?	2.04	1.49	4.79	Yes	105	23	74	32	1.74
	<b>Average</b>	<b>1.83</b>	<b>1.47</b>	<b>3.22</b>						<b>1.64</b>
<b>E</b>	<b>Interest to acquire knowledge</b>									
1	Are you interested to know about environmental research on hazard management in your community?	2.41	2.50	-0.68	No	133	16	79	43	2.46
2	Are you interested to know / obtain information from a mining company on hazard management?	2.63	2.46	1.57	No	130	10	82	38	2.54
3	Are you interested to know about mining company monitoring and control of hazardous activities?	2.70	2.43	2.61	No	122	10	79	27	2.57
4	Are you interested to know more about mine risk and hazard management in your community?	2.64	2.57	0.63	No	105	23	74	32	2.60
	<b>Average</b>	<b>2.60</b>	<b>2.49</b>	<b>1.03</b>						<b>2.54</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>F</b>	<b>Companies' project initiatives</b>									
1	Is there any environmental project initiated by a mining company in your community?	1.63	1.33	2.90	No	172	6	79	26	1.51
2	Is there any socio-economic investment made by a mining company in your community?	1.70	1.61	0.81	No	172	6	79	26	1.67
3	Has a mining company undertaken any environmental research on hazard management in your community?	1.70	1.39	2.88	No	133	16	79	43	1.54
4	Are there any projects on hazards undertaken by a mining company in your community interest?	1.70	1.33	3.63	Yes	133	16	79	43	1.51
5	Has there been any project undertaken by a mining company on community risk and hazard prevention?	1.68	1.26	3.91	Yes	105	23	74	32	1.45
6	Is there any co-project undertaken by community, State and mining companies on risk and hazard management?	1.84	1.27	4.96	Yes	105	23	74	32	1.53
	<b>Average</b>	<b>1.71</b>	<b>1.37</b>	<b>3.18</b>						<b>1.53</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>G</b>	<b>Participation via project initiatives</b>									
1	Has your community any specific decisions against mining hazards?	1.55	1.34	2.17	No	172	6	79	26	1.47
2	Has your community participated with a mining company on environmental hazard decisions?	1.66	1.33	3.39	Yes	172	6	79	26	1.53
3	Has equipment been bought for hazard management in your community?	1.66	1.35	2.97	No	130	10	82	38	1.51
4	Has your community been involved in any mining company monitoring and control activities for hazards?	1.89	1.28	5.41	Yes	122	10	79	27	1.59
5	Has the municipality ever taken part in community monitoring and control activities for hazards?	1.75	1.27	4.31	Yes	122	10	79	27	1.52
	<b>Average</b>	<b>1.70</b>	<b>1.31</b>	<b>3.65</b>						<b>1.52</b>
<b>H</b>	<b>Personal observation</b>									
1	Are you happy with your surroundings?	1.40	1.19	2.08	No	172	6	79	26	1.32
2	Are you satisfied with environmental research on hazard management in your community?	1.47	1.14	2.98	No	133	16	79	43	1.31
	<b>Average</b>	<b>1.44</b>	<b>1.17</b>	<b>2.53</b>						<b>1.31</b>

**ENVIRONMENTAL LEGAL APPLICATION and COMPLIANCE**

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>A</b>	<b>Awareness about environmental legal application and compliance</b>									
1	Are you aware of environmental legislation in your community?	2.42	2.01	3.28	Yes	106	10	57	26	2.23
2	Are you aware of environmental legislation related to mine hazards in your community?	2.37	2.06	2.34	No	106	10	57	26	2.23
3	Are you aware of the National Environmental Management Act (Act No. 107 of 1998) requirements in your community?	1.80	1.57	2.19	No	146	15	15	101	1.69
4	Are you aware of National Environmental Management Act compliance in your community?	1.68	1.47	2.18	No	146	15	15	101	1.58
5	Are you aware of the environment and conservation?	2.37	2.25	1.12	No	153	4	16	101	2.31
6	Are you aware of the Environment Conservation Act (Act No. 73 of 1989)?	2.01	1.73	2.56	No	153	4	16	101	1.89
7	Are you aware how a mining company implements the Environment Conservation Act in your community?	1.73	1.57	1.54	No	153	4	16	101	1.66

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
8	Are you aware of the Minerals Act (Act No. 50 of 1991) in your community?	2.17	2.26	-0.87	No	145	15	57	103	2.22
9	Are you aware of mining company application of the Minerals Act?	1.94	1.85	0.93	No	145	15	57	103	1.89
10	Are you aware of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) in your community?	1.83	1.78	0.53	No	126	17	59	101	1.80
11	Are you aware of any mining company application of the Mineral and Petroleum Resources Development Act in your community?	1.61	1.63	-0.18	No	126	17	59	101	1.62
12	Are you aware of the change from the Minerals Act to the Mineral and Petroleum Resources Development Act?	1.75	1.60	1.41	No	126	17	59	101	1.66
	<b>Average</b>	<b>1.97</b>	<b>1.81</b>	<b>1.42</b>						<b>1.90</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>B</b>	<b>Information received via education</b>									
1	Has your community been educated on environmental legislation relating to hazards?	1.94	1.55	3.07	Yes	106	10	57	26	1.76
<b>C</b>	<b>Information received via industry or local government</b>									
1	Has a mining company ever informed your community about the National Environmental Management Act requirements / compliance?	1.63	1.47	1.72	No	146	15	15	101	1.56
2	Has the municipality ever informed your community about the National Environmental Management Act requirements / compliance?	1.62	1.50	1.25	No	146	15	15	101	1.56
3	Has a mining company ever informed your community about Environment Conservation Act compliance?	1.53	1.47	0.63	No	153	4	16	101	1.50
4	Has the municipality ever informed your community about mining company Environment Conservation Act compliance?	1.67	1.52	1.45	No	153	4	16	101	1.60
5	Has a mining company ever informed your community about the application of the Minerals Act?	1.53	1.62	-0.95	No	145	15	57	103	1.58
6	Has the municipality ever informed your community about the application of the Minerals Act?	1.54	1.58	-0.34	No	145	15	57	103	1.56
7	Has a mining company ever informed your community about the application of the Mineral and Petroleum Resources Development Act?	1.57	1.56	0.10	No	126	17	59	101	1.57
8	Has the municipality ever informed your community about mining company application of the Mineral and Petroleum Resources Development Act?	1.55	1.52	0.26	No	126	17	59	101	1.53
	<b>Average</b>	<b>1.58</b>	<b>1.53</b>	<b>0.51</b>						<b>1.56</b>

Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>D</b>	<b>Interest to acquire knowledge</b>									
1	Are you interested to know about environmental hazards and environmental legislation in your community?	2.68	2.86	-1.94	No	106	10	57	26	2.76
2	Are you interested to know about mining company application of the National Environmental Management Act?	2.86	2.69	2.40	No	146	15	15	101	2.78
3	Are you interested to know about mining company Environment Conservation Act compliance?	2.73	2.66	0.87	No	153	4	16	101	2.69
4	Are you interested to know about the application or change in application of the Minerals Act?	2.64	2.55	1.01	No	145	15	57	103	2.59
5	Are you interested to know about mining company application of the Mineral and Petroleum Resources Development Act?	2.72	2.51	2.44	No	126	17	59	101	2.60
	<b>Average</b>	<b>2.72</b>	<b>2.65</b>	<b>0.96</b>						<b>2.69</b>
<b>E</b>	<b>Communication link</b>									
1	Is there a link between mining company and community participation in environmental legislation?	1.88	1.65	1.86	No	106	10	57	26	1.77
2	Is there a link between community and State participation in environmental legal aspects?	1.91	1.60	2.48	No	106	10	57	26	1.76
3	Is there a tripartite communication link between community, mining companies and municipality on environmental regulation?	1.78	1.58	1.63	No	106	10	57	26	1.69
	<b>Average</b>	<b>1.86</b>	<b>1.61</b>	<b>1.99</b>						<b>1.74</b>



Number of Item	Topic and Sub-Topics	Learners	General Population	t-test for Variance	Significant	Number of Learners	General Population			Average Score for Entire Population
							Mine Workers	General Workers	Unemployed	
<b>F</b>	<b>Collective efforts via legislation</b>									
1	Has there ever been a collective effort between the municipality, a mining company and the community on National Environmental Management Act compliance?	1.62	1.49	1.36	No	146	15	15	101	1.56
2	Do you see any need for a collective effort on National Environmental Management Act compliance?	2.26	2.31	-0.41	No	146	15	15	101	2.28
3	Has there ever been a collective effort between the State, a mining company and the community in Environment Conservation Act compliance?	1.57	1.62	-0.53	No	153	4	16	101	1.59
4	Do you see any need for such a collective effort on the Environment Conservation Act?	2.33	2.48	-1.45	No	153	4	16	101	2.40
5	Has there ever been a joint effort between the municipality, a mining company and the community in the application of the Minerals Act or changes?	1.65	1.55	0.97	No	145	15	57	103	1.60
6	Has there ever been a joint effort between the municipality, a mining company and the community on the application of the Mineral and Petroleum Resources Development Act?	1.67	1.54	1.27	No	126	17	59	101	1.59
	<b>Average</b>	<b>1.85</b>	<b>1.83</b>	<b>0.20</b>						<b>1.84</b>
<b>G</b>	<b>Personal observation via legislation</b>									
1	Has your community contributed to environmental legislation relating to hazards?	1.82	1.49	2.65	No	106	10	57	26	1.67
2	Is your community aware of a mining company's compliance with the National Environmental Management Act?	1.71	1.79	-0.82	No	145	15	57	103	1.76
	<b>Average</b>	<b>1.77</b>	<b>1.64</b>	<b>0.91</b>						<b>1.71</b>



## **Annexure 8: Multiple-Choice Questionnaire Respondents Classified by Occupation, Details of Interviewees, and Details of Attendees at the Focus Group Discussion**

The multiple-choice questionnaire respondents classified by occupation, details of interviewees, and details of attendees at the focus group discussion are given on the following pages.



**Multiple-Choice Questionnaires: Respondents Classified by Occupation**

<b>Heading / Sub-heading</b>	<b>Learners &gt;17 years old</b>	<b>Mine Workers</b>	<b>General Workers</b>	<b>Unemployed</b>	<b>Total</b>
<b>Health Hazards</b>					
Dust Exposure	339	22	43	96	500
Noise and Vibration Exposure	305	41	46	108	500
Temperature and Heat Exposure	315	31	54	90	490
Coal-mining and Coal-processing Gases	352	26	45	77	500
Hazard and Health Exposure	183	13	52	24	272
<b>Disaster Preparedness and Awareness Response</b>					
Coal Fires and Fire-Fighting Equipment	265	12	58	141	476
Air-Quality Monitoring	303	11	40	121	475
Explosives and Explosions	226	21	66	132	445
Underground Surveillance	304	31	30	105	470
<b>Strategic Environmental Management Decisions/Planning</b>					
Environmental Hazards and Planning Decisions	172	6	79	26	283
Environmental Research on Hazards	133	16	82	40	271
Equipment on Hazard Management	130	10	83	38	261
Monitoring and Control Systems for Hazards	122	10	79	27	238
Improve Risk and Awareness Practices	105	23	74	32	234
<b>Environmental Legal Application and Compliance</b>					
Environmental Legislation on Hazards	106	10	57	26	199
National Environmental Management Act, Act No. 107 of 1998 (RSA 1998)	146	15	15	101	277
Environment Conservation Act, Act No. 75 of 1989 (RSA 1989)	153	4	17	101	275
Minerals Act, Act No. 50 of 1991 (RSA 1991)	145	15	57	103	320
Mineral and Petroleum Resources Development Act, Act No. 28 of 2002 (RSA 2002)	126	27	69	82	304

### Resident Members of the Community Interviewed

Title	Name of interviewee	Age	Position held/Occupation and duration of involvement where available	Duration of residence in the community	Duration and time of interview	Place of interview	Date of interview
Mr	Mathebula Sunday	26 years	Ward 9 Councillor (since 2006)	8 years (since 1998)	30 minutes (09:30 to 10:00)	Vosman (in a shebeen)	18 August 2006
Ms	Mmathabo Mrubata	40 years	Co-ordinator of <i>Basa njengo Magogo</i> project and Winner of a Nedbank Capital Green Mining Award	4 years (since 2004)	25 minutes (12:00 to 12:25)	Vosman (community hall)	31 August 2006
Mrs	Rebecca Hlope	60 years	Community elder and member of <i>Basa njengo Magogo</i> project	27 years (since 1981)	45 minutes (09:00 to 09:45)	In her house (Ext 14)	19 April 2007

### Non-Resident Members of the Community Interviewed

Ms	Linah Masellane Malatjie	46 years	Mayor of Municipality (since 2006)	6 years (since 2002)	30 minutes (14:00 to 14:30)	Mayor's Parlour	12 March 2007
Mr	Paul van Castle	56 years	Speaker of Municipality (since 1994)	14 years (since 1994)	10 minutes (09:10 to 09:20)	Vosman (outside the air-quality monitoring caravan)	28 June 2006
					30 minutes (15:00 to 15:30)	Speaker's Office	05 May 2007
Ms	Fatima Ferraz	45 years	Anglo Coal Environmental Project Officer (since 1996)	10 years (since 1996)	5 minutes (11:20 to 11:25)	Vosman (outside the air-quality monitoring caravan)	28 June 2006

### Focus Group Discussion

Attendees	Number of attendees	Chaired by	Absentees
Ward Councillors only	20 of 46 members	The Speaker of the Municipality	The Mayor The Public Relation Officer The Secretary at the Mayor's office