Social Impact of Opencast Mine Blasting:

Ikwezi Mining Affected Communities near Dannhauser and Newcastle in KwaZulu-Natal

This report was prepared for:

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Executive Summary

Introduction

Mine blasting is the controlled use of primarily explosives to break mineral-bearing rock for excavation. Explosives used in mining are chemical compounds or mixtures that react at high speed. This liberates gas and heat resulting in high pressures, which in turn results in both ground and air vibration shockwaves.

This report was commissioned by the Centre for Environmental Rights (CER). The CER is an NGO and law clinic comprised of activist lawyers who defend the right of communities and civil society organisations to an environment not harmful to health or wellbeing for present and future generations using litigation, advocacy and activist support and training. Through its engagements with communities, the CER has over the years received numerous complaints from people living near mines which conduct blasting operation detailing how mine blasting significantly affects their health and well-being. As part of the CER's advocacy work, the Activist Support and Training programme is looking into several avenues to contribute to the improvement of conditions of communities living near opencast mine blasting operations. One focus is on improving legislation regulating opencast mine blasting while others relate to supporting communities with relevant information and training, enhancing the responsiveness of authorities as well as the compliance of mines to the few laws which currently provide some protection to communities affected by mining. To this end, CER commissioned a social impact assessment study of the communities affected by the Ikwezi Mining's operations near Dannhauser.

Background

Ikwezi Mining Limited was incorporated on 02 May 2011 as a Bermuda exempt company, and on 16 May 2011, the company acquired all the shares in Naledi Holdings, which at that time held 70% interest in the Newcastle Project, with the remaining 30% interest held by Ikwezi Mining Holding (pty) Ltd, which was Ikwezi Mining Limited's BEE partner in its endeavours. The Newcastle Project is of relevance for this paper.

On 23 February 2012, a Mining Right was issued to Ikwezi Mining (pty) Ltd for the area referred to as the Newcastle Project. A Mining Right entitles the right holder the use of such surface rights as is necessary or incidental for mining activities. According to the Mining Right issued to Ikwezi Mining (pty) Ltd, the right holder must compensate the surface owner for actual loss or damage suffered by the surface owner as a result of prospecting or mining activities.

The Newcastle Project is located approximately 28km southeast of Newcastle, along the R34 road, primarily within the Dannhauser Local Municipality of the Amajuba District in KwaZulu Natal (KZN). The Amajuba District Municipality comprises the Newcastle and eMadlangeni local municipalities, with Dannhauser being the smallest of three local municipalities within the district. The local municipality is predominantly a rural municipality, stretching over approximately 1516km^2, 58 settlement areas and consisting of 13 wards.

The Newcastle Project covers an area of 12,181.2 ha of farmland of which 8,808 ha has potential minable coal resources. This area lies within local municipal wards 1, 5, 7, 10 and 12, with much of it falling under the Buhle Bomzinyathi Traditional Authority. Although the exact numbers of households during at the time of the study is not known, the 2020/2021 Dannhauser Local Municipality Integrated Development Plan (IDP), indicate that in 2016, the approximate number of residents in the municipal wards affected by the Ikwezi Mining operation, were 38,917 (pg.3). Due to the expansion of the mine – at the time of the study three collieries were in operation, with a fourth in planning stage – a significant number of these households and individuals are living in close proximity to the collieries and are affected by the mine's blasting and other operational activities.

Approximately 59 million tons of coal is available for mining, and it is expected that the life of mine will be approximately 30 years.

On 11 June 2012, an Environmental Management Programme (EMPr) was approved for the Doornkop Colliery. On 22 March 2013 an Integrated Water Use License was issued for the Ntendeka Colliery. It appears as if these authorisations were for the same colliery, which is now referred to as the Kliprand Colliery.

The mining method currently used is opencast conventional strip mining. Blasting is one of the most commonly used techniques in this type of mining method. Explosives are used to break rock to enable for the removal of the overburden and to excavate the ore.

All processing of the coal mined at the collieries in the study area takes place at a washing plant, Emoyeni Plant, which is located a few kilometres away from the Kliprand and Goedehoop Collieries along the R34. Coal is transported to the washing facility via the R34 from the Goedehoop and Kliprand Collieries, whilst the coal from the Shepstone Lake Colliery is transported via roads within the communities and via the R34.

Those farms which Ikwezi Mining did not outright purchase, currently belong to different entities and individuals. Significant for this study are the landowners of, amongst others, Kaalvlakte and Drangan, on whose land many of the communities live and thrive. The other significant stakeholder is the Ingonyama Trust, which owns Buhle Bomzinyathi farm. The Zulu King, and by default the Ingonyama Trust, is represented by an Induna, Mr B.L. Zulu, of the Emalangeni Traditional Council.

A third significant stakeholder is the leader of the Mhlongamvula Kingdom, which although recognized by the Mdutshwa Community (living around the Shepstone Lake Colliery) as their traditional leader, is not recognized by Ikwezi Mining as a traditional leader because he is not registered with the Department of Cooperative Governance and Traditional Affairs (CoGTA). At the time of the qualitative study, the Mhlongamvula Kingdom's application was being finalized with CoGTA.

The most important stakeholders in this study site are the communities, and of the 16 directly affected by the Ikwezi Mining's Dannhauser operations, four communities participated in the qualitative study.

The Ikwezi Mining-affected communities' land use and livelihoods revolve mainly around livestock husbandry and kitchen gardens. The communities are served by a well-run government clinic and several primary and high schools. There are also numerous early childhood education facilities (crèches), which also form the main part of the company's Social and Labour Plan (SLP) social investment activities since the collieries started to operate.

At the time of the study, Ikwezi Mining was operating three opencast collieries: Kliprand, Goedehoop and Shepstone Lake.

Mining Right: KZN 30/5/1/2/2/297 MR (held by Ikwezi Mining)		
Kliprand Colliery – Previously known as (i) 'Doornkop Colliery' (the Environmental Management Program - EMPr - was approved on 11 June 2012 under this name); (ii) as well as 'Ntendeka Colliery' (the Integrated Water Use License was approved on 22 March 2013 under this name). These earlier names are no longer in use.	**Goedehoop Colliery –** Started production in May 2022	**Shepstone Lake Colliery –** Started production during 2023

At the time of writing, the company was starting to prepare for the Verdriet Colliery.

Relevant Legislation

The legislation specifically providing for mining activities in South Africa is the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA). The legislation recognises the State as the custodian and guardian of the country's mineral resources.

Whilst the MPRDA governs the acquisition, use and disposal of mineral rights in South Africa, it leaves the management and control of blasting, vibration and shock to the Mine Health and Safety Act 29 of 1996 (MHSA); and the protection of the environment (including human health and wellbeing) to the National Environmental Management Act 106 of 1998 (NEMA). Many of NEMA's provisions apply in the context of mining and mine blasting. Of particular importance to blasting operations are the principles contained in section 2 and the duty of care in section 28.

The NEMA principles serve as guidelines to any organ of state, such as the Department of Mineral Resources and Energy, or the Principal Inspector of Mines, which they must refer to when taking any decision in terms of NEMA or a different law, such as the MPRDA or the MHSA, when the decision concerns the protection of the environment. In the context of mine blasting, this means that should a state official decides, for example, to grant a mining right, or approve an Environmental Management Programme or Plan (EMPr) or give permission to blast within 500m from public infrastructure, the official must consider the NEMA principles.

Section 28 of NEMA imposes a duty of care. It provides that every person who causes significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing, or recurring; or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

This duty applies to mines conducting blasting where there are significant impacts on the environment. Examples from case law where the duty of care has been found to apply include the dumping of soil into a dam during construction, mining an area and distributing asbestos fibres into the surrounding environment, and clearing of land for development in an ecologically sensitive environment.

South African law does not impose limits on ground and air shockwaves caused by mine blasting operations. It does however, require mines to conduct a risk assessment, consult with communities and apply for permission should blasting be conducted within 500 metres from homes or other public infrastructure. Research conducted by the United States Bureau of Mines (USMB) is generally accepted in South Africa by both mines and the Department of Mineral Resources and Energy as providing non-binding guidelines as to ground and air blast vibration limits and their impacts on various kinds of infrastructure.

Methodology

A qualitative methodology was used for this study. It comprised primarily of focus group discussions and key informant interviews.

Four communities affected directly by Ikwezi's operations were selected for the study. These communities are affected by the Kliprand, Goedehoop and Shepstone Lake collieries.

Fieldwork was undertaken in two phases. During the initial fieldwork trip from 13 to 22 February 2024, seven focus group discussions were conducted, and 10 key informants were interviewed.

On 01 March 2024, a meeting to discuss the research and its findings were held with Ikwezi Mining in their head office in Johannesburg.

Emails with follow-up questions were sent to Ikwezi Mining on 07th and 10th March 2024, with several reminders until 10th April 2024 when the company declined to provide responses to follow-up questions. On 25 April 2024, a draft of this report was sent to Ikwezi Mining for their comments, with a follow-up reminder email on 03 May 2024. There was no response from the company.

A second trip to the communities were undertaken from 15 to 19 March 2024 to provide feedback to the communities, and to interview those persons whom Ikwezi Mining indicated should also be interviewed.

Results

The impacts of Ikwezi Mining's blasting in its three collieries near Dannhauster, as described by members of the communities living near the collieries, are:

Psychosocial Impacts:

- Signs of trauma in young children and the aged;
- Community members no longer feeling at peace in their homes;
- Community members, particularly women, are worried about the safety of their children and loved ones;
- Community members are worried about their homes and whether the walls, which are cracking, can withstand the next blast;
- Teachers and nurses worried about the children and patients in their care;
- Teachers, particularly those teaching at school located close to the colliers, are worried that the classrooms will collapse on top of the children during, and in the aftermath of, a blast.
- Feelings of anger in some community members, which has found expression in demonstrations against the company; whilst particularly the older

community members expressed a 'helplessness'. This impact is exacerbated by the lack of a functioning grievance mechanism.

- The changes in the landscape, from rolling green hills to mine dumps and mine dust turning grass black around the wash plant, also significantly affects the communities, especially the older community members, who report their sense of place, belonging and wellbeing in connection to the biophysical space being negatively impacted by the blasting and the transformation of the landscape.

Cultural impacts:

- The destruction of the area around the Shepstone Lake has had a lasting impact on the community's cultural beliefs and spiritual connection to its sacred places.

Economic impacts:

- Buildings cracking or collapsing (especially if the owner is still busy building) has significant negative economic impacts on the community. This is exacerbated by the non-functioning grievance mechanism, which results in few claims against the mine being investigated and even fewer settled.
- Livestock runs away during blasts, resulting in hours wasted looking for them, time which could be used for more productive activities.
- When livestock runs away during blasts, they are sometimes injured and die; or are stolen, which results in losses for the owner.
- The reduction of safe grazing areas for livestock.

Productivity:

- When people are moved out of the 500m zone, they lose up to three hours of productive time, in which they are unable to conduct their normal activities.
- Physical injuries from, for example, falling when the blast suddenly happens, also results in loss of productivity, loss of income and can result in the loss of health.

Recommendations

The following recommendations are based on my expert opinion as a sociologist with 30 years' experience, 20 of those in the mining industry:

- Education, information and training: Government should ensure that the ongoing trauma experienced by young children living in opencast mine areas be addressed urgently. Government, the Minerals Council, and Ikwezi Mining could play a constructive role in this effort by creating a roadshow to all the schools in the affected areas and explain to the children, at a level appropriate

to their ages, the different aspects of mining and what happens when a mine blasts. Very often the trauma is reduced when children (and adults) understand the process involved in mining. In this regard, NEMA specifically provides an imperative that "*Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means*."[1]

- Public participation and communication: The mine should improve its communication with communities impacted by the mine's activities. For instance, blasting notices should be sent out to community members, including those working at schools and the clinic who might not reside in the communities but who work in the community, via SMS notifying the households of which colliery will blast and when. Such SMSs should be sent at least 48 hours in advance of a proposed blast. The time-frame in which the blast occurs should be minimised to two hours, thus: a blasting notice should indicate as follows: "Blasting at Shepstone Lake on Thursday, 4 July 2024 between noon and 14h00", instead of "Blasting at Shepstone Lake on Thursday, 4 July 2024 between noon and 18h00". There should also be blasting notice boards in the community, e.g. at the Banana Supermarket's bus stop which is frequented by nearly everyone affected by the company's operations, at the clinic and at other spaza shops in the various communities. These should be updated daily.

- Blast shockwave mitigation and timing: The mine should make every attempt to minimise ground and air vibration shockwaves generated by blasts.[2] Similarly, the mine should make all attempts to reduce dust and fume emissions, as well as flyrock. Blasting operations at the collieries should only be conducted between two hours (for example between noon and 2pm) and these hours should be known in the surrounding areas and communicated well in advance to affected communities.

- Transparency and access to information: When permission to blast within 500 meters from community infrastructure is required, the mine should have a standard process as to how it conducts the required consultations with affected community members. Similarly, the mine should have a standard process for how the required risk assessment is conducted. These processes should be provided to the communities impacted by mine blasting in an open

[1] NEMA section 2(4)(h)
[2] For instance through technological advancements, explosive selection and blast design.

and transparent manner. Blasting permits granted by the Principal Inspector of Mines should be available upon request by affected community members without requiring an application under the Promotion of Access to Information Act for all permits issued to it to blast. These permits could also be posted on Ikwezi Mining's website. The mine's health and safety policy should also be available upon request to any community member and published on its website.

- Grievance Mechanism: Ikwezi Mining should develop, implement and maintain a functional grievance mechanism as soon as possible. It is vital that the grievance mechanism should detail the processes that must be followed by both the mine and the affected household when there are claims of damage to property as a result of the mine's blasting activities. The grievance mechanism and its processes should be known to the affected communities and should also be published on the mine's website for easy access.

- Suitable blasting standards: Government should formalize blasting standards suitable for South African rural and traditional communities. The Minerals Council should participate in contributing to these important discussions.

- Care of duty: It is also important that more work be done in examining the application and use of NEMA's duty of care in the context of blasting operations.

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Acronyms

CoGTA	Department of Cooperative Governance and Traditional Affairs
dB	Decibel
DMRE	Department of Mineral Resources and Energy
EMPr	Environmental Management Programme
IDP	Integrated Development Plan
MHSC	The Mine Health and Safety Council
MHSA	Mine Health and Safety Act No 29 of 1996 (Amended Act 74 of 2008)
MPRDA	Mineral and Petroleum Resources Development Act No 28 of 2002
NEMA	National Environmental Management Act 106 of 1998
PPV	Peak Particle Velocity
SAHRC	The South African Human Rights Commission
SLP	Social and Labour Plan
SDF	Spatial Development Framework
USBM	United States Bureau of Mines

Definitions

Air blast	The airborne shock wave generated by an explosion.
Flyrock	Any rock fragments thrown unpredictably from a blast.
Ground vibration	The vibration of the ground which is induced by elastic waves emanating from a blast.
Mine blasting	It is the necessary, but also the most hazardous, aspect of mining operations that involves the use of explosives to break down hard rock formations to access minerals.
PPV	Peak particle velocity. This is the peak velocity of a particle or the peak vibration amplitude in a vibration trace recorded by a geophone. Units are mm/s
Stemming	Stemming is an inert material such as drill cuttings, gravel, clay, screened aggregate etc. which is inserted into the collar of a blasthole after charging with the aim of sealing the hole temporarily in order to prevent the venting of gases, reduce air blast and contain flyrock.

Researcher's Qualifications and Experience

I have 30 years' experience in all aspects of community development and engagement, human rights, community relations, community investments, corporate social responsibility, corporate social risk, monitoring and evaluation, and public-private partnerships; both in the public, aid and private sectors. Twenty years of this experience include work in the extractive industry (mining, oil and gas, and timber), with twelve years working with project-affected resettlement. Since 2018, I have been working as an expert witness in mediation, arbitration and court cases related to resettlement and other social impacts. I have worked extensively in the following countries: South Africa, Namibia, Kenya, Tanzania, Ethiopia, Uganda, Zambia, Ghana, and Mali, with limited experience in South Sudan, Peru and the Philippines.

A PhD degree was conferred on me by the Nelson Mandela Metropolitan University in 2010 and I am a member of the following professional bodies: the International Association for Impact Assessment and the International Development Evaluation Association.

Background

Mine blasting is the controlled use of primarily explosives to break mineral-bearing rock for excavation. Explosives used in mining are chemical compounds or mixtures that react at high speed. This liberates gas and heat resulting in high pressures, which in turn results in both ground and air vibration shockwaves.

In 2022, in order to measure ground and air blasting levels over a period of three months, the Centre for Environmental Rights (CER) appointed Blast Management & Consulting to install three seismographs in the communities surrounding the Ikwezi coal mine, located near Dannhauser in KwaZulu-Natal. The resulting data was compared to the recommended blasting levels contained in the United States Bureau of Mining (USBM) Standard RI 8507, which is widely accepted by the Department of Mineral Resources and Energy (DMRE) and the South African mining industry as there are currently no legally prescribed limits for ground or air wave vibrations from mine blasting in South African law.

The findings from the analysis of the seismograph data were that the Ikwezi coal mine was conducting fewer blasts per month than expected, and that the majority of the blast levels fell below the USBM RI 8507 recommended limits. Despite these findings, the broader Ikwezi-affected community reported continued harm as a result of mine blasting.

CER is pursuing several avenues in order to improve legislation related to mine blasting; to support communities with relevant information; to enhance the responsiveness of authorities including the mine health and safety inspectorate; as well as the compliance of mines to the few laws which currently provide some protection to communities affected by mining. To this end, CER commissioned a social impact assessment study of the communities affected by the Ikwezi Mining's operations near Dannhauser.

The purpose of the social impact study is to produce an expert report with the intention to use the report for:

- Motivation for law reform calling for more protection for affected communities in the Mine and Health and Safety Act and the Environmental Impact Assessment regime under the National Environmental Management Act;

- Engagement with government authorities involved in mine blasting including the Department of Mineral Resources and Energy, the Mine Health and Safety Inspectorate, the Mine Health and Safety Council, the Mining Regulations Advisory Committee and the South African Human Rights Commission (SAHRC);

- Raising the profile of mine blasting complaints nationally to recognize mine blasting as a violation of human rights;

- Amplifying the voices and challenges faced by those living in close proximity to mines which conduct open cast blasting operations;

- Developing scholarly research into the content of wellbeing as envisaged in Section 24(a) of the Constitution of the Republic of South Africa, which provides that "*Everyone has the right to an environment that is not harmful to their health and wellbeing.*"; and

- Use in potential litigation to show the social impact of mine blasting on a community.

Mining and Blasting

This section provides information related to mining activity and blasting to allow for a better understanding of the issues.

Opencast Mining

Opencast mining (also sometimes referred to as open-cut mining) is a surface mining technique that extracts minerals from an open-pit in the ground.

For opencast mining to commence, the first step is to remove the surface vegetation and to stockpile the topsoil for later use in reclamation. Reclamation is the processes by which adverse environmental effects of opencast mining are minimized and through which mined lands are returned to a beneficial end use.

One would normally only remove the vegetation and topsoil in the area that will be mined within a period of weeks. Next, in order to gain initial access to the seam, a box cut needs to be done. A box cut is a trench (or small open pit) made to expose a portion of the coal seam. Depending on the hardness and tightness of the overburden (the rock and/or soil layer that needs to be removed for the box cut), it may be necessary to drill and blast to facilitate its removal. The overburden from the box cut will be placed to the side of the pit.

When the coal seam under the box cut is exposed, the mining of the coal commences. After the coal in the box cut is removed, a subsequent cut is accomplished and the overburden from the second cut is placed in the space created by the initial box cut. This process continues by making subsequent cuts, putting extracted overburden in the former cut, and mining the uncovered coal seam. The collection of sequential cuts forms a strip, and the strips will traverse a portion of the pit.

What is blasting?

Blasting is one of the most commonly used techniques for overburden removal and ore excavation in mining operations. Explosives are used to break rock through the shock waves and gasses yielded from the explosion.

Most commonly blasting involves the following:

(i) Drilling holes. Holes are drilled in such a pattern which requires a minimum quantity of explosives per volume of rock that needs to be broken.
(ii) Placing a charge and detonator in each hole
(iii) Detonating the charge. The holes are fired in a pre-determined order, at intervals of only thousandths of a second.

When the charge is detonated, the energy in the explosives is released and the pressure shatters the area around the drill hole and exposes the rock to very high stress that causes cracks to form in the rock.

What are the side-effects of blasting?

Ground Vibration

Ground vibration is a natural, and inevitable, result from blasting activities. The intensity of the ground vibration is however dependant on various factors. The factors that influence ground vibration are: (i) the charge mass per delay, (ii) the distance from the blast, (iii) the delay period, and (iv) the geometry of the blast.

These factors are generally controlled by planned design and proper blast preparation. The larger the charge mass per delay, and not necessarily the total mass of the blast, the greater the vibration energy produced.

Blasts should be timed to produce effective relief and rock movement for successful breakage of the rock. A certain quantity of holes will detonate within the same time frame (delay) and it is the maximum total explosive mass per such delay that will have the greatest influence.

Ground vibrations reduce over distance at a rate determined by the mass per delay, timing and geology. Closer to the blast will yield high levels and further from the blast will yield lower levels. The geology of the area has influences as well. Each geological interface a shock wave encounters will reduce the vibration energy due to reflections of the shock wave. High-density materials (e.g. solid rock) have high shock wave transferability where low density materials (e.g. sand) have low transferability of the shock waves.

Air blast

Air blast, also referred to as air-overpressure, is the direct result from the blast process. It should not be confused with sound that is within audible range and detected by the human ear.

Whilst Hertz (Hz) is a unit of frequency commonly used to specify the frequency of soundwaves, i.e. the number of cycles a sound wave completes in one second in, for example, a radio wave; decibels (dB) is used to quantify the relative intensity or power of an air blast. Decibels is thus a measure of magnitude; and in the context of mine blasting it is used to measure the pressure of a blast.

Sound is also a build up from pressure but is a different frequency to air blast, which is normally associated with frequency levels less than 20 Hz. The threshold for hearing is 20Hz.

The outcome that is an air blast is influenced by a variety of factors, such as meteorological conditions, the final blast layout, timing, stemming, accessories used, whether covered or not covered etc. The three main causes of air blasts are: (i) direct rock displacement at the blast; (ii) vibrating ground some distance away from the blast; and (iii) venting of blast holes or blowouts.

A well-confined explosive charge creates pressure waves with frequencies that are predominantly less than 20Hz, with a relatively small amount of energy having frequencies above 20Hz. This influences the loudness of the sound a person might hear from the blast.

Most studies, including those by Siskind *et.al.* (1980)[3] and others, observed a few cases of minor damage at air blasts equivalent to 134dB[4] (which translates into a gust of wind at approximately 45km per hour), and further concluded that 140dB represents a reasonable threshold for glass and blaster damage.

In 1994, Persson *et.al.*[5] published the following findings based on empirical data:

Level	Description
120 dB	Threshold for pain from continuous sound
> 130 dB	Resonant response of large surfaces, e.g. ceiling, roof. At this level, complaints from affected households generally start
150 dB	Some windows break

[3] Siskind, D.E., V.J. Stachura, M.S. Stagg and J.W. Kopp (1980) *Structure Response and Damage Produced by Air blast From Surface Mining.* US Bureau of Mines RI 8485.

[4] Measures the intensity and magnitude of the pressure of the blast.

[5] Persson, P. A., R. Holmberg and J. Lee (1994) *Rock Blasting and Explosives Engineering*. Boca Raton, Florida: CRC Press.

170 dB	Most windows break
180 dB	Structural damage

The recommended limit for air blast currently applied in South Africa is 134 dB[6] but it is generally recommended that all attempts should be made to keep air blast levels generated from blasting operations below 120 dB or greater magnitude toward critical areas where the general public and/or affected communities is of concern.

Flyrock

Flyrock is considered to be the main cause of numerous cases of property damage and injuries in surface mining.[7]

Flyrock occurs as a result of the release of energy from the explosion (blast). Rock fragments are propelled and thrust high into the air and beyond the safety limit of the blast area. Beyond safe permissible limits, flyrock can cause serious damage to property and can inflict serious to fatal injury to both the workers on the mine as well as other persons.

Although the incidents of flyrock can never be brought down to zero, it is possible to blast without any flyrock with proper confinement of the explosive charges within blast holes using proper stemming procedures and materials[8]. Stemming is the plugging of the blast hole to prevent the escape of blast gasses, which ensure that the explosive energy is efficiently used. Proper control of stemming will prevent any flyrock or excessive air blast and noise being generated from the blast surfaces.

Noxious Fumes

Post-blast fumes are a direct product of the blasting process which can be easily identified as the yellow to orange post-blast clouds.

Blasting operations produce both toxic and nontoxic gaseous products; the toxic being mainly carbon monoxide (CO) and the oxides of nitrogen (NOx). Large surface mines may detonate up to two million pounds of blasting agent in a single shot. Some of the shots produce a red or orange cloud, colours which signify the presence of nitrogen dioxide

[6] Based on work carried out by Siskind et.al. (1980) – the USBM RI 8485 authors -, monitored air blast amplitudes up to 134dB are safe for structures, provided the monitoring instrument is sensitive to low frequencies (down to 1 Hz).

[7] Lundborg, N. (1974) *The hazards of fly rock when blasting*. Report DS 1974:12. Swedish Detonic Foundation (SveDeFo), Stockholm, Sweden.
Lundborg, N., Persson, A., Ladegaard-Pedersen, A., and Holmberg, R. (1975) *Keeping the lid on flyrock in open-pit blasting*. Engineering and Mining Journal, May 1975. pp. 95–100.
Bajpayee, T. S., Verakis, H. and T. Lobb (2007) *An Analysis and Prevention of Flyrock Accidents in Surface Blasting Operations*.

[8] Raina, A.K., Chakraborty, A.K., Choudhury, P.B. *et al.* (2011) *Flyrock danger zone demarcation in opencast mines: a risk-based approach*. Bulletin of Engineering Geology and the Environment **70**, 163–172 (2011).

(NO_2). It is not known whether the red or orange cloud contains toxic levels of NO_2 since there have been no direct measurements which have been published in reports.[9] Currently in South Africa explosives used are required to be oxygen balanced. This means that there is exactly enough oxygen (O_2) present to completely oxidize the fuel contained in the explosives, but none left over to react with the contained nitrogen.

Factors contributing to undesirable fumes include poor quality control on explosive manufacture, damage to explosive, lack of confinement, insufficient charge diameter, and types of ground.

[9] Barnhart, C. R. (2004) *Analytical Measurements in Cast Blasting to Identify the Cause and Cure for "Orange Smoke."* Proceedings of the 30th Annual Conference on Explosives and Blasting Technique, February 1-4 (pp 1-15) Cleveland, OH: International Society of Explosives Engineers.
Barnhart, C. R. (2003) *Understanding the "Orange Smoke" Problem in Cast Blasting. Proceedings of the 29th Annual Conference on Explosives and Blasting Technique*, February 2-5 (pp. 1-11) Cleveland, OH: International Society of Explosives Engineers.
Lawrence, D. L. (1995) *A Study of Post Blast Generation of Nitrogen Dioxide. Proceedings of the 22nd Annual Conference on Explosives and Blasting Technique*. February 2-5 (pp 1-12) Cleveland, OH: International Society of Explosives Engineers.

Legal Context, Policies and Guidelines

The Constitution of the Republic of South Africa Act 108 of 1996

The Constitution of the Republic of South Africa, which is the supreme law of the Republic, contains the Bill of Rights, which grants all people in the country fundamental human rights. It underpins the democratic values of human dignity, equality and freedom.

The provisions in the Constitution that are of particular relevance here are Sections 24, 25 and 26.

Section 24 provides that: "*Everyone has the right –*

(a) to an environment that is not harmful to their health and well-being; and
(b) to have the environment protected for the benefit of present and future generations."

Section 25 provides that:

> *"(1) No one may be deprived of property except in terms of law of general application, and no law may permit arbitrary deprivation of property."*

Section 26 provides that:

> *"(1) Everyone has the right to have access to adequate housing.*
>
> *(3) No one may be evicted from their home, or have their home demolished, without an order of court made after considering all the circumstances. No legislation may permit arbitrary evictions."*

The rights to human dignity (refer to Section 7 of the Bill of Rights), which states that everyone has inherent dignity and the right to have their dignity respected and protected; and the right to equality (refer to Section 6 of the Bill of Rights), which includes the full and equal enjoyment of all rights and freedoms; are also important when one considers the impacts of mining in general on individuals and communities, as well the impacts of open cast mine blasting in specific.

Mineral and Petroleum Resources Development Act 28 of 2002

The legislation specifically providing for mining activities in South Africa is the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA). The legislation recognises the State as the custodian and guardian of the country's mineral resources.

Whilst the MPRDA governs the acquisition, use and disposal of mineral rights in South Africa, it leaves the management and control of blasting, vibration and shock to the Mine Health and Safety Act 29 of 1996 (MHSA). Section 23(1)(f) of the MPRDA provides that a

mining right under the MPRDA must only be granted if the applicant has the ability to comply with the relevant provisions of the MHSA.

Section 37(2) of the MPRDA provides that "*Any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations",* which implies that the National Environmental Management Act 106 of 1998 (NEMA) applies to all prospecting and mining operations.

Mine Health and Safety Act 29 of 1996

The Mine Health and Safety Act (MHSA) regulates the health and safety requirements of mine employees and communities affected by mining operations.

Specifically Section 5(2)(b) imposes a duty of mines beyond employees: "(b) *ensure that persons who are not employees, but who may be directly affected by the activities at the mine, are not exposed to any hazards to their health and safety"*; and Section 8(1)(c) requires the mine to establish health and safety policies for affected communities: *"Every employer must prepare a document that (c) establishes a policy concerning the protection of persons who are not employees but who may be directly affected by activities of the mine".*

Regulations Relating to Explosives (updated as per GN953, 14 September 2018)

In terms of Section 98 of the Mine Health and Safety Act of 1996, regulations related to explosives were issued in 1997 and have subsequently been updated, most recently in September 2018.

Regulation 4.7 states that *"the employer at any mine must take reasonable measure to ensure that when blasting takes place, air and ground vibrations, shock waves and fly material are limited to such an extent and at such a distance from any building, public thoroughfare, railway, power line or any place where persons congregate to ensure that there is no significant risk to the health or safety of persons".*

The Regulations further lists the following general precautions under Regulation 4.16:

The employer must take reasonable measures to ensure that:

(1) at any mine other than a coal mine, no explosive charges are initiated during the shift unless –

a) such explosive charges are necessary for the purpose of secondary blasting or re-initiating the misfired holes in development faces;

b) *written approval for such initiation has been granted by a person authorised to do so by the employer; and*
c) *reasonable precautions have been taken to prevent, as far as possible, any person from being exposed to smoke, fumes or fly rocks from such initiation of explosive charges.*

Unfortunately, neither the Act, nor the Regulations stipulate limits for ground vibration, air blast levels, or fly rock.[10] However, Regulation 4.16(2) does limit blasting within 500m from certain structures unless various conditions are met.

Regulations 4.16(2) provides as follows:

"no blasting operations are carried out within a horizontal distance of 500 metres of any public building, public thoroughfare, railway line, power line, any place where people congregate or any other structure, which it may be necessary to protect in order to prevent any significant risk, unless:

(a) a risk assessment has identified a lesser safe distance and any restrictions and conditions to be complied with;
(b) a written application is submitted to the Principal Inspector of Mines accompanied by the following documents for approval –
    (i) a sketch plan indicating the distance from the blasting areas to the affected structures;
    (ii) the risk assessment;
    (iii) a proof of consultation with the owners of the affected structures; and
    (iv) restrictions and conditions.
(c) a written approval has been granted by the Principal Inspector of Mines; and
(d) any restrictions and conditions determined by the Principal Inspector of Mines are complied with.

National Environmental Management Act 106 of 1998

Although the National Environmental Management Act (NEMA) does not directly regulate mining operations, Section 37 of the MPRDA provides that the NEMA principles apply to all prospecting and mining operations and that these principles must serve as guidelines for the interpretation, administration and implementation of the environmental requirements of the MPRDA.

Section 2 of NEMA states the following:

[10] Similarly, neither the Explosives Act (as amended, No. 15 of 2003) nor the Occupational Health and Safety Act 85 of 1993 and their associated regulations, stipulate limits for ground vibrations, air blast levels, and distances that flyrock may travel. The South African National Standard (SANS) 4866:2011 likewise do not provide limits for vibrations and only set specifications for the monitoring of blasts.

"(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

(3) Development must be socially, environmentally and economically sustainable.

(4) (a) Sustainable development requires the consideration of all relevant factors including the following:

(iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;

(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and

(viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied."

NEMA and mine blasting

Many of NEMA's provisions apply in the context of mining and mine blasting. Of particular importance to blasting operations are the principles contained in section 2 and the duty of care in section 28.

NEMA defines 'environment' broadly. Under NEMA, 'environment' means the surroundings within which humans exist and that are made up of:

- the land, water and atmosphere of the earth;
- micro-organisms, plant and animal life;
- any part or combination of these, and the interrelationships among and between them; and
- the physical, chemical, aesthetic and cultural properties and conditions of the above that influence human health and well-being.

Especially pertinent in the context of mine blasting, is NEMA's definition of environment to specifically include reference to conditions that influence human health and well-being.

NEMA principles

The NEMA principles apply to the actions of all organs of state that may significantly affect the environment. They apply alongside the Constitutional duty of the state to respect, protect, promote and fulfil social and economic rights and in particular the basic

needs of people disadvantaged by discrimination. The NEMA principles serve as the general framework within which environmental management must be formulated.

The NEMA principles serve as guidelines to any organ of state, such as the Department of Mineral Resources and Energy, or the Principal Inspector of Mines, that they must refer to the NEMA principles when taking any decision in terms of NEMA or a different law, such as the MPRDA[11] or the MHSA[12], when the decision concerns the protection of the environment. In the context of mine blasting, this means that if a state official decides, for example, to grant a mining right, or approve an EMPr[13], or give permission to blast within 500m from public infrastructure; the official must consider the NEMA principles.

The NEMA principles also guide the interpretation, administration and implementation of any law concerned with the protection or management of the environment.

The MPRDA as well as the MHSA contain provision which empower the DMRE and the Principal Inspector of Mines to make decisions which may have significant environmental impacts. It must be remembered that NEMA's definition of 'environment' includes reference to conditions that influence human health and well-being. In these circumstances, the NEMA principles therefore apply. For instance, under the MHSA, the Principal Inspector is empowered to grant permission to a mine to blast within 500m of community houses if certain conditions have been met. There is therefore a legal imperative on the Principal Inspector to consider the NEMA principles when deciding whether to grant the permission to blast within a 500m radius.

Important principles in the mine blasting context are:

- *Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.*
- *Development must be socially, environmentally and economically sustainable.*
- *Sustainable development requires the consideration of all relevant factors including the following:*
    - *that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;*
    - *that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;*
    - *that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;*

[11] Mining and Petroleum Resources Development Act
[12] Mine Health and Safety Act
[13] Environmental Management Programme/Plan

    - *that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and*
    - *that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.*
- *Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.*
- *Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.*
- *Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.*
- *The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.*
- *Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.*
- *The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.*
- *Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.*
- *The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.*
- *The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.*
- *The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.*

- *The full participation of previously disadvantaged professionals, with specific emphasis on black professionals and indigenous knowledge practitioners in the environmental management sector, must be recognised and their participation in the sector promoted.*
- *Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.*

Consideration of the NEMA principles by state officials when making decisions such as issuing permits or licences does not prevent such authorisations being granted, but a decision maker must justify the decision in light of the principles and other countervailing factors if one is granted.

The NEMA Duty of Care

Section 28 of NEMA imposes a duty or care. It provides that every person who causes significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing, or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

This duty applies to mines conducting blasting where there are significant impacts on the environment. Examples from case law where the duty of care has been found to apply include the dumping of soil into a dam during construction, mining an area and distributing asbestos fibres into the surrounding environment, and clearing of land for development in an ecologically sensitive environment. More work should be done in examining the application and use of the duty of care in the context of blasting operations.

International Blasting Standards

It is widely accepted that the 500m zone limits used in the South African legislation, the mining industry and by the Department of Minerals Resources and Energy (DMRE) are based on research conducted by the United States Bureau of Mines (USBM).

The United States Bureau of Mines Standard R18507

The United States Bureau of Mines (USBM) was the lead agency in studying the effects of blasts on low-rise residential type structures from 1910 until 1996. One of the main objectives was to obtain a wide spectrum damage criterion that could be adapted in producing blasting regulations that would prevent threshold damage. Threshold damage was defined as the occurrence of cosmetic damage; that is, the most superficial interior cracking of the type that develops in all homes independent of blasting.

The USBM prepared three reports over a period of forty years that culminated in the publication of USBM Report of Investigation (RI) 8507[14] in 1980.

As part of the research conducted, direct measurements were made of ground-vibration-produced structure responses and damage in 76 homes for 219 production blasts. These results were combined with damage data from nine other blasting studies. The RI 8507 presents a criterion that delineates safe blasting limits to prevent threshold vibration damage to low-rise, residential type structures for a wide spectrum of frequences.

Safe levels of ground vibration from blasting range from 0.5 to 2.0 inches (1.27 to 5.08cm) per second peak particle velocity for residential-type structures. The damage threshold values are functions of the frequencies of the vibration transmitted into the residences and the types of construction. Particularly serious are the low-frequency vibrations that exist in soft foundation materials and/or result from long blast-to-residence distances. These vibrations produce not only structure resonances but also excessive levels of displacement and strain. Homes with plastered interior walls are more susceptible to blast-produced cracking than gypsum wallboard.

When structure response amplification factors were measured, typical values were 1.5 for structures as a whole and 4 for interior walls, at their respective resonance frequencies. For blast vibrations above 40 Hz, all amplification factors for frame residential structures were less than unity.

Most importantly, the following was highlighted: The human response and annoyance problem from ground vibration is aggravated by wall rattling, secondary noises, and the presence of air blast. Approximately 5 to 10% of the affected households will judge peak particle velocity levels of 0.5 to 0.75 inches/second as less than acceptable (i.e., unacceptable) based on direct reactions to the vibration. Even lower levels cause psychological response problems, and thus social, economic, and public relations factors become critical for continued blasting.

Recommended Ground Vibrations and Air Blast Limitations

In recent years, there have been small developments[15] towards the regulation of mine blasting in South Africa.

The CSIR and the Mine Health and Safety Council (MHSC) conducted several studies which looked at the effect of blasting on nearby communities which culminated in a

[14] The authors and title of the document are:
Siskind, D.E., Stagg M.S., Kopp, J.W. and C.H. Dowding (1980) *Structure Response and Damage Produced by Ground Vibration from Surface Mining*. US Bureau of Mines RI 8507

[1515] The Mining Regulations Advisory Committee (MRAC) established a task team to facilitate the development of a guidance note on Minimum Standards on Ground Vibration, Noise, Air blast and Flyrock. Although this draft guidance, dated 12 February 2020, was available online for a period; at the time of writing, neither the draft, nor a finalized version of the document, could be found online.

report[16], that "*describes leading international and local practice for designing, executing and monitoring opencast blasts and dealing with nearby communities, and recommends practices, procedures and standards that take the South African situation into account"* (pg.7). The report acknowledges the harm caused by mine blasting to surrounding communities and natural resources; notes the international standards relied on by South African mines, which includes the USBM standards; and recommends practices, procedures and standards that take the South African situation into account.

In 2016, the South African Human Rights Commission (SAHRC) held national hearings on underlying socio-economic challenges faced by mining-affected communities in the country. In respect of blasting impacts, the Commission heard complaints detailing safety concerns, claims of damage to housing and other infrastructure, increased levels of dust and noise pollution, lack of sufficient notice, and the general disruption caused to communities by mine blasting. The SAHRC identified the following as crucial factors in the report[17]:

(i) blasting is carried out in a way that is not conducive to a respect for human dignity and the safety and well-being of persons in affected communities;
(ii) monitoring and evaluation of blasting operations is conducted by mining companies;
(iii) a number of mining companies submitted that damage to infrastructure is often a result of poor-quality structures and not a direct result of blasting operations;
(iv) mining companies should consider the quality of housing structures before carrying out blasting operations; and
(v) the practical difficulties in providing compensation where blasting is determined to be the direct cause of damage to community structures.

The Commission found that *"the lack of regulation around blasting operations is problematic given the frequency in which issues arise. Discrepant practices across the industry and the propensity for blasting operations to negatively impact communities and the environment compound the seriousness of these issues. The Commission further finds that industry bodies, such as the Chamber of Mines[18], are not duly active in monitoring behavioural trends within the industry or guiding members on best practice concerning blasting operations. The Commission identifies an immediate need for the*

[16] Brovko, F., Kgarume, T., Singh, N., Milev, A., Wekesa, B., Durrheim, R., Lumbwe, T. Pandelany, T. and M. Mwila (2016) *Development of a South African Mining Standard on Ground Vibration, Noise, Air-Blast and Flyrock near Surface Structures to be protected*. Milestone 6: Project Final Report. Mine Health and Safety Council. CSIR.
[17] SAHRC (2017) *National hearing on the underlying socio-economic challenges of mining-affected communities in South Africa. 13-14 September; 26 and 28 September; 3 November 2016*. South African Human Rights Commission
[18] Now called the Minerals Council of South Africa

DMR[19], as the competent authority responsible for developing regulations, to take urgent action to address this gap. The Commission finds that mining companies are responsible for ensuring that, prior to conducting blasting operations, appropriate safety mechanisms are in place to prevent property damage (with due consideration given to the quality of the structures in surrounding communities) and any risk to persons' health and safety. Mining companies should conduct ongoing engagements to ensure that such operations occur in a manner that has the least impact on people and the environment." (pg.5)

Although there are no statutory limits for ground vibrations and air shock waves in South African law, most responsible mining companies abide by the limits recommended by experts in the field. These limits are listed in the tables below.

Table 1: Recommended Ground Vibration Limits

Structure Description	Ground Vibration Limit (mm/s)
National Roads and tar roads	50
Electrical Lines (pylons)	75
Railway	150
Transformers	25
Gas/fuel Lines	25
Water Wells	50
Telecoms Tower	50
General Houses of Proper Construction	25 (USBM Criteria)
Houses of Lesser Proper Construction	12.5 (USBM Criteria)
Rural Building – Mud Houses	6 (USBM Criteria)

Source: Table provided by mining consultant firm, Blast Management and Consulting, with figures based on industry accepted recommendations and the USBM standard.

Table 2: Air Blast Limitations

Descriptions	Air Blast Level (dB)
Complaints start	125
Resonant Response to Large Surfaces (roofs, ceilings)	>130
Recommended South African Limit	134
Some windows break	150
Most windows break	170
Structural Damage	180

Source: Table provided by mining consultant firm, Blast Management and Consulting, with figures based on industry accepted recommendations and the USBM standard.

[19] Now called the DMRE

Ikwezi Mining Limited

Ikwezi Mining Limited was incorporated on 02 May 2011 as a Bermuda exempt company, which means it is exempted from those provisions of the 1981 Bermuda Companies Act which stipulates that at least 60% of equity must be beneficially owned by Bermudians.

On 16 May 2011 the company acquired all the shares in Naledi Holdings, which at that time held 70% interest in the Newcastle Project, with the remaining 30% interest held by Ikwezi Mining Holding (pty) Ltd, which was Ikwezi Mining Limited's BEE partner in its endeavours. The Newcastle Project is of relevance for this paper.

At that time, Ikwezi Mining Limited also had a 60% interest in each of the Newcastle Phase 2 and Acorn projects. Ikwezi Mining Holdings (pty) Ltd, Ikwezi Mining Limited's BEE partner, held 25% shared in each of Newcastle Phase 2 and Acorn projects. The Newcastle Phase 2 project comprised approximately 4,664ha near Dundee in KwaZulu Natal, and the Acorn Project approximately 20,758ha in Gauteng.

In 2011, Ikwezi Mining Limited had three subsidiaries: Ikwezi Mining (pty) Ltd (its BEE partner); Bokamoso Resources (pty) Ltd, which was the holder of both the Newcastle Phase 2 and the Acorn Projects; and Ikwezi Mining Services Proprietary Limited.

Ikwezi Mining Limited released its Prospectus for the initial public offering of shares in the company on 15 June 2011 and was admitted to the official list of the Australian Security Exchange (ASX) on 15 July 2011 and its official quotation commenced on 19 July 2011. At that time, the company only had Prospecting Rights for the Newcastle Project. Prospecting Rights does not confer authority to commence development and production, for these activities, a Mining Right and a Water Use Licence are required. In order for a Mining Right to be granted, the company must submit a Scoping Report, an Environmental Impact Assessment (EIA), an Environmental Management Programme (EMPr), and consult with landowners and lawful occupiers.

On 23 February 2012, a Mining Right was issued for the area referred to as the Newcastle Project. The Mining Right was issued to Ikwezi Mining (pty) Ltd, the BEE partner, which was registered in South Africa in 2010, with registration number 2010/019996/07. A Mining Right entitles the right holder the use of such surface rights as is necessary or incidental for mining activities. According to the Mining Right, the right holder must

compensate the surface owner for actual loss or damage suffered by the surface owner as a result of prospecting or mining activities.[20] [21]

The Newcastle Project is located approximately 28km southeast of Newcastle, along the R34 road, primarily within the Dannhauser Local Municipality of the Amajuba District in KwaZulu-Natal (KZN). It covers an area of 12,181.2 ha of farmland[22] of which 8,808 ha has potential minable coal resources. This area lies within local municipal wards 1, 5, 7, 9, 10 and 11, with much of it falling under the Buhle Bomzinyathi Traditional Authority.

KwaZulu-Natal's five coal fields are Klip River, Utrecht, Vryheid, Nongoma and Somkele. The Newcastle project falls within the central part of the Klip River Coalfield, which is structurally complex, with several displaced blocks, mainly caused by faulting affecting the coal formations. Like the other KZN coalfields, it is characterised by thin seams of high-quality coal. It has two coal seams, the Top Seam and the Bottom Seam, which are separated by coarse grained sandstone that is pebbly, cross-bedded and fining upwards to shale at the top. The spacing between the Top Sean and the Bottom Seam ranges from less than a metre to 25 metres in places. Various dolerite intrusions cut through the area vertically as dykes, and horizontally as sills. The sills displace the overlying sediments by distances equal to their thickness, while dykes cause some burning and devolatisation[23] of the coal.

The Newcastle Project is a long-term deposit with a 25-to-30-year Life of Mine, which would involve the following activities: the operation of opencast pits which would involve mining, blasting and a contribution of various stockpiles; coal processing including crushing, screening and washing; use of public roads and transport routes; and the temporary storage of waste and permanent disposal of coal discard in a disposal facility.

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[20] Mining Right to Ikwezi Mining (Pty) Ltd issued on 23 February 2012: Paragraph 11.1: Subject to section 43 of the Act, the Holder shall, during the tenure of this right while carrying out the mining operations under this right, take all such necessary and reasonable steps to adequately safeguard and protect the environment, the mining area and any person/s using or entitled to use the surface of the mining area from any possible damage or injury associated with any activities on the mining area
Paragraph 11.2: Should the holder fail to take reasonable steps referred to above, and to the extent that there is legal liability, the holder shall compensate such person or persons for any damage or losses, including but not limited to damage to the surface, to any crops or improvements, which such person or persons may suffer as a result of, arising from or in connection with the exercise of his/her rights under this mining right or any act or omission in connection therewith."

[21] See also Section 54(3) and 54(4) of the MPRDA

[22] The farms affected are: Rooipoort No. 10745 HT; Alleen 2 No. 4280 HT; Annie No. 8798 HT; Buhle Bomzinyathi No. 17495 HT; Cloneen No. 7591 HT; Diepsluiten No. 4270 HT; Doornsluiten No. 14366 HT; Drangan No. 8844 HT; Drooge Plaats No. 7681 HT; Goedehoop No. 3857 HT; Kaalvlakte No. 7496 HT; Kliprand No. 8627 HT; Kromdraai No. 8626 HT; Omdraai No. 3855 HT; Rooipoort B No. 7545 HT; Struisvogel Kop No. 4275 HT.

[23] Devolatisation = a decomposition process that occurs under heating when combustible gasses from coal particles are released.

The company's prospectus[24] described the expectation for the Newcastle Project as two main opencast areas, four separate underground adits[25] and two limited shallow opencast mini pits. Although these areas would be mined separately, they would share a central processing facility (the wash plant).

On 11 June 2012, an Environmental Management Programme (EMPr) was approved for the Doornkop Colliery. On 22 March 2013 an Integrated Water Use License was issued for the Ntendeka Colliery. It appears as if these authorisations were for the same colliery, which is now referred to as the Kliprand Colliery. Part of the water to be used at the mine and the wash plant (also referred to as a coal preparation plant or coal beneficiation plant) was to be sourced from the old underground Ngagane Colliery workings, which is located approximately 6km from the wash plant.

In March 2013, Stefanutti Stocks Mining Services (SSMS) was contracted to undertake all mining operations at the Ntendeka Colliery[26]. They remained in place until April 2018 when CML Melger Mining (pty) Ltd took over mining operations.

By July 2018, the top soil and soft material had been successfully removed at the Kliprand Colliery, which exposed the "hards", which needs to be drilled and blasted. On 01 August 2018, Stafanutti Stocks Mining Services (SSMS) was once again contracted to do the mining, and by 27 September 2018 they had completed the initial box cut[27] and mined the first coal. By April 2020, SSMS's contract was terminated, which resulted in a dispute, which was referred to arbitration. The outcome of the arbitration is unknown. A new contractor commenced mining in June 2020. At that time, the company also submitted an application to DMRE for authorisation for a new opencast area. Both the opencast areas would be operated simultaneously.

Between May and October 2020, the company underwent several changes to its board.

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[24] Pg. 38

[25] An adit is a horizontal passage or tunnel to an underground mine, which is most commonly used, amongst other purposes, for access, drainage and/or ventilation.

[26] Also known as Doornkop, and currently referred to as Kliprand Colliery.

[27] For opencast mining (also referred to as surface mining) to commence, the first step is to remove the surface vegetation and to stockpile the topsoil for later use in reclamation. Reclamation is the processes by which adverse environmental effects of opencast mining are minimized and through which mined lands are returned to a beneficial end use. One would normally only remove the vegetation and topsoil in the area that will be mined within a period of weeks. Next, in order to gain initial access to the seam, a box cut needs to be done. A box cut is a trench (or small open pit) made to expose a portion of the coal seam. Depending on the hardness and tightness of the overburden (the rock and/or soil layer that needs to be removed for the box cut), it may be necessary to drill and blast to facilitate its removal. The overburden from the box cut will be placed to the side of the pit. When the coal seam under the box cut is exposed, the mining of the coal commences. After the coal in the box cut is removed, a subsequent cut is accomplished and the overburden from the second cut is placed in the space created by the initial box cut. This process continues by making subsequent cuts, putting extracted overburden in the former cut, and mining the uncovered coal seam. The collection of sequential cuts forms a strip, and the strips will traverse a portion of the pit.

In its 2020 Annual Report to shareholders, the company indicated that the Emoyeni coal processing/wash plant was dry commissioned during that financial year as the water supply infrastructure had not been completed yet. The wash plant has a processing capacity of approximately 3 million tonnes Run of Mine (ROM)[28] per annum with the front-end crushers and screens designed to process approximately 4 million tonnes per annum ROM. The Emoyeni plant was fully commissioned during the last quarter of the 2020 calendar year.

During December 2021, Goedehoop Colliery was brought into production, and commenced mining in May 2022.

On 25 October 2022 the company announced voluntary delisting from ASX. It gave the following reasons: low levels of trading liquidity; no physical presence or Australian operations; lack of legitimate investor interest; negative thermal coal perceptions; cost; management time and effort; and speculative trading.

On 21 December 2022, the company announced that the Shepstone Lake colliery was on track to commence production during 2023.

The company was finally delisted on 30 December 2022.

Dannhauser Local Municipality

The research area falls within the Dannhauser Local Municipality, which is located north in the Kwa-Zulu Natal Province in Amajuba District. The Amajuba District Municipality also comprises the Newcastle and eMadlangeni local municipalities, with Dannhauser being the smallest of three local municipalities within the district. The local municipality is predominantly a rural municipality, stretching over approximately 1516km^2, 58 settlement areas and consisting of 13 wards.

The Ikwezi Mining Company's mining right stretches over five wards of Dannhauser Local Municipality.

Table 3: Dannhauser Local Municipality Wards and Farms included in the Ikwezi Mining Company's Mining Right

	Farms included
Ward 1	Droogeplaats
Ward 5	Kaalvlakte, Drangaan
Ward 7	Annie, Allen
Ward 10	Omdraai, Kromdraai, Struisvogel
Ward 12	Kliprand, Cloneen, Doornkop, Doornsluiten, Goedehoop, Diepsluiten

Source: Ikwezi Mining Company Social and Labour Plan, July 2020-June 2022

Of the farms which forms part of the Ikwezi Mining Company's mining right, it was only possible to find basic demographic information for three. As per the *Dannhauser*

[28] ROM means ore from source prior to processing; thus the unprocessed mined material which includes soil and rock, coal, contamination and impurities.

Municipal Spatial Development Framework (SDF) 2017-2040, Kliprand[29] comprised 3.95km^2 and had a population of 314; Cloneen comprised of 8.99km^2 and had a population of 4360; and Doornkop comprised 20.21km^2 with a population of 1681.

According to the 2020/2021 Dannhauser Local Municipality Integrated Development Plan (IDP)[30], the approximate number of residents in the municipal wards affected by the Ikwezi Mining operation in 2016, were 38,917.

The north-eastern portion of the Dannhauser municipal area is largely land under the administration of traditional councils. It includes a portion of Ubuhlebmzinyathi Community Authority, and the Nyanyandu, Ingwe, Emalangeni and Gule Traditional Councils.

Demographics

At the time of the 2022 National Census, Dannhauser Local Municipality had a population of 142 750, compared to 102 937 during the 2011 Census. This indicates a population growth of 3.2% for the period 2011-2022, compared to the negative population growth of -0.1% recorded in the local municipality for the period 2001-2011.

Of the 2022 population, 32.5% were younger than 15 years; 61.8% were between 15 and 65 years old; and 5.7% were older than 65. The median age is 23, compared to 19 in 2011.

The total dependency ratio[31] per hundred is 61.8 compared to 76.3 in 2011.

The education level is captured in the table below.

Table 4: Level of Education in the Dannhauser Local Municipality as per Census 2022

Level of education (age 20+)	Dannhauser	Amajuba DM	KZN Province
No schooling	6.4%	5.3%	8.3%
Matric	37.1%	42.2%	41.2%
Higher education (post-matric)	5.5%	11.3%	10.4%

Source: Municipal Fact Sheet, Census 2022, StatsSA

Unfortunately, there are no current employment statistics for the local or district municipalities available; however the official[32] unemployment rate for the KwaZulu-Natal province for Q1 of 2024, was 29.9% (compared to 32.9% nationally), whilst the expanded[33] unemployment rate for the province for the same period was 43.7%

[29] Kliprand is the site of the Kliprand Colliery
[30] Page 3
[31] The dependency ratio is the number of individuals aged 0-14 and older than 65 who are dependent on those of working age, i.e. 15-64 years of age.
[32] The definition for the official (or also referred to as "strict") unemployed = A person between the ages of 15 and 64 who is willing and able to work, who is without a job, and who is actively searching for a job.
[33] The definition for the expanded unemployed = A person between the ages of 15 and 64 who is without a job, willing and able to work, but who is not actively searching for a job.

(compared to 41.9% nationally). One can safely presume that the unemployment rate for the Dannhauser Local Municipality would be much higher. According to the 2023/2024 Dannhauser Local Municipality Final Integrated Development Plan[34], whilst the local economy is largely defined by the mining and agricultural sectors, these sectors currently contribute to minimal employment within the jurisdiction, forcing most residents to seek employment in adjacent municipal jurisdictions.

Unfortunately the June 2020-June 2022[35] Social and Labour Plan (SLP) approved for the Ikwezi Mining collieries in the study area near Dannhauser does not at all address or speak to the colliers' human resources component (as is the norm[36] for SLPs), thus there is no available information related to direct or indirect employment by Ikwezi Mining or its contractors in the study area.

Household Dynamics and Living Conditions

The table below captures the household dynamics in Dannhauser Local Municipality, Amajuba District Municipality and the KwaZulu-Natal Province, compared to national conditions, as per 2022 Census.

Table 5: Household Dynamics in Dannhauser Local Municipality as per 2022 Census

	Dannhauser LM	Amajuba DM	KwaZulu-Natal	South Africa
Average household size (persons)	5.6	4.5	4.4	3.5
Female-headed households (%)	54.2	52.7	53.1	49.2

Source: Municipal Fact Sheet, Census 2022, StatsSA

As can be seen from the above, the average household in the Dannhauser Local Municipality is larger than those in the district and the province. There are also more female-headed households in the local municipality compared to the district and province.

Table 6: Household Services in Dannhauser Local Municipality as per 2022 Census

	Dannhauser LM	Amajuba DM	KwaZulu-Natal	South Africa
Formal dwellings (%)	85.5	93.5	86.8	88.5
Flush toilet connected to sewerage (%)	23.8	65.1	58.9	70.8
Weekly refuge removal (%)	21.9	63	58.1	67.1

[34] Pg. 23

[35] No other Ikwezi Mining SLP documents for the study area are publicly available.

[36] The human resources (labour) development section of an SLP would normally include sections dealing with the specific mine's labour force, detailing number and gender of workforce, geographic origin, their education level, hard to fill vacancies, career progression plans, training and study assistance available, learnerships, etc.

	Dannhauser LM	Amajuba DM	KwaZulu-Natal	South Africa
Piped Water on Site (inside dwelling and in the yard) (%)	60	89.7	77	82.4
Electricity for lighting (%)	93.9	94.8	96.7	94.7

Source: Municipal Fact Sheet, Census 2022, StatsSA

There are fewer formal dwellings in the Dannhauser Local Municipality compared to the district. This is important in the context of this report as the local municipality is an area which has many opencast mines blasting regularly.

Ikwezi Mining's Mining Activities in Dannhauser Local Municipality

The mining method currently used is opencast conventional strip mining. There are two coal seams within the area. According to the Environmental Management Programme for Doornkop[37] Colliery, dated April 2012, mining will concentrate on the top seam, although in places the bottom seam may also be mined; and that mining will take place through five separate opencast pits and four underground adits/access points. Approximately 59 million tons of coal is available for mining, and it is expected that the life of mine will be approximately 30 years. All processing of the coal takes place at a washing plant, Emoyeni Plant, which is located a few kilometres away from the Kliprand and Goedehoop Collieries along the R34. Coal is transported to the washing facility via the R34 from the Goedehoop and Kliprand Collieries, whilst the coal from the Shepstone Lake Colliery is transported via roads within the communities and via the R34. The trucks on the R34, waiting to turn into the Emoyeni Plant often make the road dangerous for users, and have in the past delayed the schools from starting on time as teachers and learners were delayed behind many trucks idling on the road, and there are numerous complaints from community members about this problem.[38]

The farms (and communities living on them) affected by the mining operations are:

Rooipoort No. 10745 HT; Alleen 2 No. 4280 HT; Annie No. 8798 HT; Buhle Bomzinyathi No. 17495 HT; Cloneen No. 7591 HT; Diepsluiten No. 4270 HT; Doornsluiten No. 14366 HT; Drangan No. 8844 HT; Drooge Plaats No. 7681 HT; Goedehoop No. 3857 HT; Kaalvlakte No. 7496 HT; Kliprand No. 8627 HT; Kromdraai No. 8626 HT; Omdraai No. 3855 HT; Rooipoort B No. 7545 HT; Struisvogel Kop No. 4275 HT.

Those farms which Ikwezi Mining did not outright purchase, currently belong to different entities and individuals. Significant for this study are the landowners of, amongst others, Kaalvlakte and Drangan, on whose land many of the communities live and thrive. The

[37] Doornkop appears to be the alternative name for the Kliprand Colliery. Another name used in earlier days is Ntendeka, which is also the colliery name for which the water licence was issued in March 2013.
[38] At a meeting with Ikwezi Mining in their Johannesburg offices on 01 March 2024, Mr Ndlovu indicated that the community's complaints are exaggerated.

other significant stakeholder is the Ingonyama Trust, which owns Buhle Bomzinyathi farm. The Zulu King, and by default the Ingonyama Trust, is represented by an Induna, Mr B.L. Zulu, of the Emalangeni Traditional Council.

A third significant stakeholder is the leader of the Mhlongamvula Kingdom, which although recognized by the Mdutshwa Community (living around the Shepstone Lake Colliery) as their traditional leader, is not recognized by Ikwezi Mining as a traditional leader because he is not registered with the Department of Cooperative Governance and Traditional Affairs (CoGTA). At the time of the qualitative study, the Mhlongamvula Kingdom's application was being finalized with CoGTA.

The most important stakeholders in this study site are the communities, and of the 16 directly affected by the Ikwezi Mining's Dannhauser operations, four communities participated in the qualitative study.

The mine has also set up a 'Mining Forum" which includes elected representatives of all 16 communities, but a member[39] of this forum interviewed on 15 March 2024, indicated that few members of the forum attend the monthly meetings on a regular basis and that there is a feeling that one cannot oppose the mine's representatives on the forum. No-one from the Dannhauser Local Municipality is included on the forum.

The Ikwezi Mining-affected communities' land use and livelihoods revolve mainly around livestock husbandry and kitchen gardens. The communities are served by a well-run government clinic and several primary and high schools. There are also numerous early childhood education facilities (crèches), which also form the main part of the company's Social and Labour Plan (SLP) social investment activities since the collieries started to operate.

At the time of the study, Ikwezi Mining was operating three collieries in the study area: Kliprand, Goedehoop and Shepstone Lake, as demonstrated in Table 7 below.

Table 7: Current collieries operated by Ikwezi Mining in the study area under Mining Right: KZN 30/5/1/2/2/297 MR

Mining Right: KZN 30/5/1/2/2/297 MR (held by Ikwezi Mining)		
Kliprand Colliery – Previously known as (iii) 'Doornkop Colliery' (the Environmental Management Program - EMPr - was approved on 11 June 2012 under this name);	**Goedehoop Colliery –** Started production in May 2022	**Shepstone Lake Colliery –** Started production during 2023

[39] This person requested to remain anonymous in fear of retribution from Ikwezi Mining

(iv) as well as 'Ntendeka Colliery' (the Integrated Water Use License was approved on 22 March 2013 under this name). These earlier names are no longer in use.		

Methodology

A qualitative methodology was used for this study. It comprised primarily of focus group discussions and key informant interviews.

Four communities affected directly by Ikwezi's operations were selected for the study. These communities are affected by the Kliprand, Goedehoop and Shepstone Lake collieries.

The sampling method for the data collection was a combination of purposive (judgement), convenience and quota sampling. These sampling techniques were used because the participants are known and there is advanced knowledge about the appropriate characteristics of the population. The sample can also further be narrowed based on who of the possible respondents would be available and willing to participate, and quota sampling will be used to increase the representativeness of the final sample.

An integral part of the study was a review of all relevant literature.

Fieldwork was undertaken in two phases, and the initial trip was undertaken from 13 to 22 February 2024. During this period, seven focus group discussions were conducted, and 10 key informants were interviewed.

On 01 March 2024, a meeting to discuss the research and its findings were held with Ikwezi Mining in their head office in Johannesburg.

Emails with follow-up questions were sent to Ikwezi Mining on 07th and 10th March 2024, with several reminders until 10th April 2024 when the company declined to provide responses to follow-up questions. On 25 April 2024, a draft of this report was sent to Ikwezi Mining for their comments, with a follow-up reminder email on 03 May 2024. There was no response from the company.

A second trip to the communities was undertaken from 15 to 19 March 2024 to give the community feedback but also to interview those persons whom Ikwezi Mining indicated should also be interviewed.

Table 8: Focus Group Discussions and key informant interviews conducted

Focus Group Discussions			
Date	**Community/Area**	**Gender**	**Number Participants**
13 February 2024	Kliprand Colliery-affected	Male & Female, all ages	27
13 February 2024	Kliprand Colliery - affected	Female	4
15 February 2024	Shepstone Lake	Female & Male, all ages	12
15 February 2024	Mdutshwa Community	Male & Female	18
16 February 2024	Landowners	Male	7
18 February 2024	Mdutshwa Community	Male & Female	35
19 February 2024	Shepstone Lake	Female	4
20 February 2024	Mnyamande High School	Male & Female Grade 12 students	30
20 February 2024	Mnyamande High School	Male & Female teachers	16
18 March 2024	Mhlongamvula Kingdom Council	Male & Female	6
Key Informants			
Date	**Institution**	**Gender**	
16 February 2024	Sunrise Creche /Mbabane Cash Farm	Female	
16 February 2024	Head of Nurses at Clinic	Female	
18 February 2024	Mhlongamvula Kingdom Leader	Male	
18 February 2024	Sangoma	Female	
19 February 2024	HOD Embabane Primary School	Male	
21 February 2024	Mata Primary School	Female	
21 February 2024	Mwethu High School	Male	
21 February 2024	Kliprand resettled – Mrs N. Hadebe	Female	
21 February 2024	Goedehoop – Mrs H. Hadebe – resettled from Kliprand	Female	
21 February 2024	Goedehoop – Mrs P. Hadebe – resettled from Kliprand	Female	
15 March 2024	Ward Councillor	Male	
15 March 2024	Member of the Mining Forum	Male	
16 March 2024	Induna – Emalangeni Traditional Council	Male	

Results

This section reports back on the results of the research done by CER in 2022, as well as qualitative research conducted during February and March 2024.

Monitoring Blasting at the Kliprand Colliery

As a result of community complaints related to blasting, CER's Activist Support and Training programme contracted mining experts Blast Management & Consulting to install three monitoring stations in the communities surrounding Ikwezi Mining's Kliprand Colliery. Currently Ikwezi Mining operates three collieries in the broader community, namely the Kliprand, Goedehoop and Shepstone Lake collieries. At the time of writing, the company was starting to prepare for the Verdriet Colliery.

The tables below indicate the blasts recorded at the Kliprand Colliery during February, March and April 2022, as well as the blasts' levels of ground vibrations and air blast intensity.

Table 9: Summary of Blasts at Kliprand Colliery in February 2022

Seismograph Location	Data	Total
Point 1	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	6 2.68 131.6
Point 2	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	6 4.85 132.5
Point 3	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	5 1.74 126.8
Total Count of Date		17
Total Max of Max PPV (mm/s)		4.85
Total Max of Air Blast (dB)		132.5

Source: Blast Management & Consulting

The maximum air blast for February 2022 was 132.5 dB and 130.2 dB for March 2022, which is under the 134 dB recommended in the USBM standards. The maximum ground vibrations for February and March were 4.85 mm/s and 2.87 mm/s which are well below the USBM recommended limit of 12.5 mm/s. It is also lower than the recommended limits for houses of lesser proper construction[40] and mud houses[41], both which are common in the communities surrounding the Kliprand Colliery.

Table 10: Summary of Blasts at Kliprand Colliery in March 2022

Seismograph Location	Data	Total
Point 1	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	4 2.43 129.7

[40] Recommended ground vibration limit for houses of lesser proper construction = 12.5 mm/s
[41] Recommended ground vibration limit for mud houses = 6 mm/s

Point 2	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	3 2.87 130.2
Point 3	Number of blasts Max of PPV (mm/s) Max of Air blast (dB)	2 0.14 122.6
Total Count of Date		9
Total Max of Max PPV (mm/s)		2.87
Total Max of Air Blast (dB)		130.2

Source: Blast Management & Consulting

In April 2022, there were far fewer blasts than the previous two months, most likely due to heavy rains. During this period, whilst the ground vibration levels were well below the USBM limits, the mine exceeded the 134 dB threshold for air blasts on two occasions.

Table 11: Summary of Blasts at Kliprand Colliery in April 2022

Seismograph Location	Data	Total
Point 1	Number of blasts Max of PPV (mm/s) Max of Air blast	1 0.90 140.6
Point 2	Number of blasts Max of PPV (mm/s) Max of Air blast	2 0.89 140.2
Point 3	Number of blasts Max of PPV (mm/s) Max of Air blast	1 0.39 133.1
Total Count of Date		4
Total Max of Max PPV (mm/s)		0.90
Total Max of Air Blast (dB)		140.6

Source: Blast Management & Consulting

The table below shows, in red, when and how Kliprand Colliery exceeded air vibration standards in April 2022.

Table 12: Incidents when blasting exceeded air vibration USBM standards at the Kliprand Colliery during April 2022

Date	Time	Seismograph location	L-PPV	T-PPV	V-PPV	L-Freq	T-Freq	V-Freq	R-PPV	Air Blast
22/04/2022	12:14	Point 02	0.19	0.14	0.20	23.27	8.00	32.00	0.26	120.3
28/04/2022	15:09	Point 01	0.34	0.35	0.90	8.98	13.84	18.96	0.90	140.6
28/04/2022	15:09	Point 02	0.58	0.21	0.89	21.33	30.12	34.13	1.01	140.2
28/04/2022	15:09	Point 03	0.37	0.24	0.39	32.00	23.37	19.69	0.52	133.1

Source: Blast Management & Consulting

It is important to note that this 2022 study only concentrated on one colliery, Kliprand, but at the time of the qualitative impact study in 2024, three collieries were in operation in relatively close proximity (a few kilometres apart) from each other. All three collieries were blasting at the time of the qualitative impact study in 2024.

Qualitative Study Results

The qualitative study focusing on the impact of blasting on the households living and working in close proximity to Ikwezi Mining's three collieries near Dannhauser was conducted in February and March 2024. The three collieries in operation at the time of the study are: Kliprand, Goedehoop and Shepstone Lake. Four communities living and working in close proximity to the collieries participated in the qualitative study.

Broad Impacts

Respondents were asked what they considered the broad impacts of mine blasting were on them and their communities.

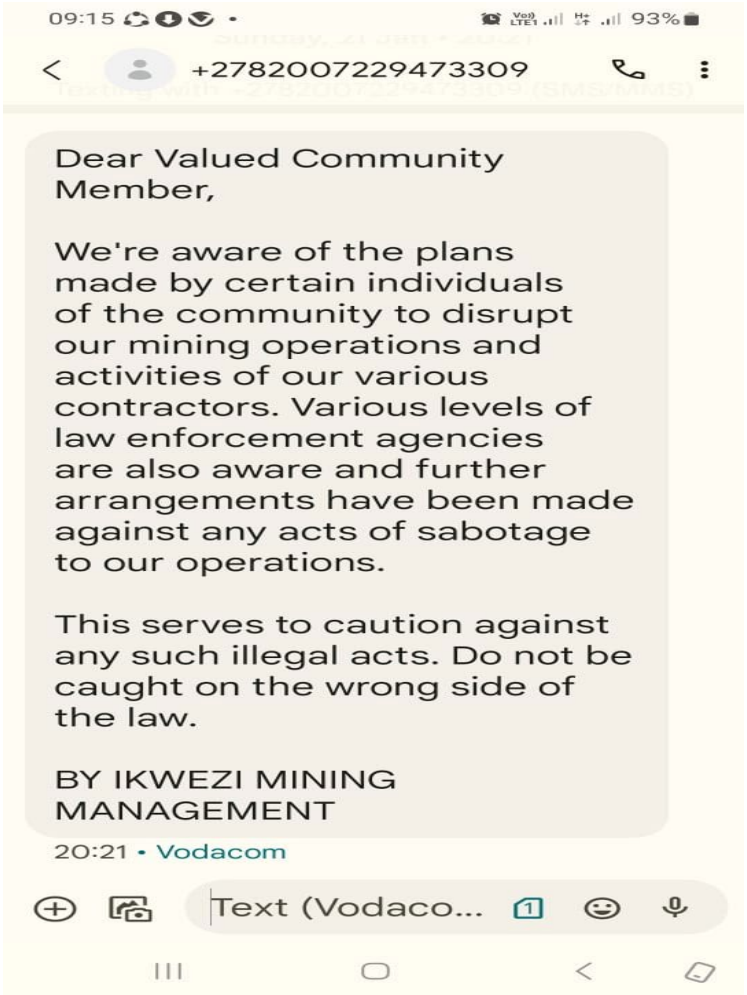
- "They blast about two times a week at the moment. They blast normally in the afternoon, sometimes in the morning, but mostly in the afternoon. Sometimes between 5pm until sunset. They do not blast after sunset." [Woman, Mdutshwa Community, 15 February 2024]

- "Depending on the age and circumstances and the distance from the pits, it varies from discomfort to trauma" [Woman, Shepstone Lake, 13 February 2024]

- "We are farmers. We want to live in peace, we don't want to be traumatized by the mine with their blasting, their trucks, their threats[42]; we want to be free on our own land. The mine must do the right thing. We want the economy of our country to recover, but this is not the way to do it. Our land is becoming valueless, and it won't be able to feed us for much longer, and this is due to this mine." [Landowner, 16 February 2024]

[42] Many respondents have reported that the mine sends them threatening messages via SMS. In a meeting with the mine on 01 March 2024, Mr Ndlovu, said that these were not meant to be threats, but rather warnings and reminders to the community not to break the law.

Figure 1: Text message sent to Ikwezi-affected communities near Dannhauser



Many persons complained that the blasting scares their cattle and other livestock, and that they often have to walk for kilometres looking for lost animals. This wastes a lot of time, and it also leads to stock losses, which has an impact on their livelihood.

Lack of Adequate Notice of Intended Blasting

According to the International Labour Organization[43] (ILO) *Code of Practice: Safety and health in opencast mines*, "a charge of explosives should not be fired in an opencast mine unless and until:

(a) the person in charge of the blast as cleared all persons from the danger zone, and has posted sentries at all points of entry to prevent inadvertent access (for example, and depending on the circumstances, an exclusion zone of 500m may be established);
(b) proper warning has been given:
    (i) in all adjacent areas from which a person might approach the danger zone; and
    (ii) over all radio channels and once a warning is given, radio silence should be imposed;
(c) all persons who are in places where they might be injured by the blasting have been warned; and
(d) all such persons have taken adequate shelter or left the area." (ILO, 2018[44], paragraph 607, pg. 174)

Paragraph 609 continues: "Where blasting at an opencast mining operation could constitute a public nuisance or danger, the competent authority may require the installation of an audible warning device or other form of notification" (ILO, 2018, pp. 174-175)

Like what the South African Human Rights Commission found during the 2016 national hearings on underlying socio-economic challenges faced by mining-affected communities in the country, one of the most frequent complaints by the Ikwezi-affected communities was that there is not adequate notice about when the mine will blast.

Despite what the Ikwezi 2012 EMPr states on pg. 32: "*The blasting schedule (times and frequency) must be published onsite and distributed to surrounding land users. A log of any correspondence must be kept on-site"*, the only two blasting notice boards which are placed (i) the Kliprand Colliery's entrance, and (ii) the Shepstone Lake Colliery's entrance, were completely out-of-date. On 13 February 2024, the board indicated that blasting will take place on 05/12/2023 between 12h00 and 18h00. When the out-of-date boards were raised with Mr Ndlovu of Ikwezi Mining at a meeting on 01 March 2024, he indicated that the notice boards are for the mine's employees only, and not for the communities, but

[43] South Africa has been a member of the ILO from 1919 to 1966, and again since 1994. The ILO's mandate is aimed at realising a dent work agenda: creating jobs, guaranteeing rights at work, extending social protection, and promoting social dialogue.
[44] ILO (2018) *Code of Practice: Safety and health in opencast mines*. International Labour Organisation, Geneva

that it is wrong that they are not updated. Despite this, the board remained unchanged on 16 March 2024.

Figure 2: Blasting Notice Board at Kliprand Colliery entrance (photographed on 20 February 2024)

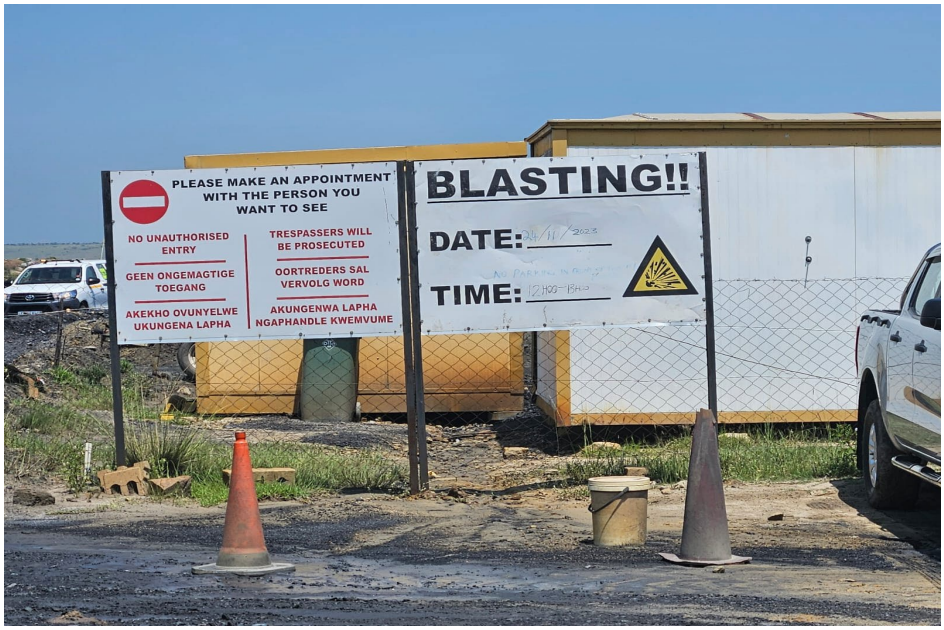
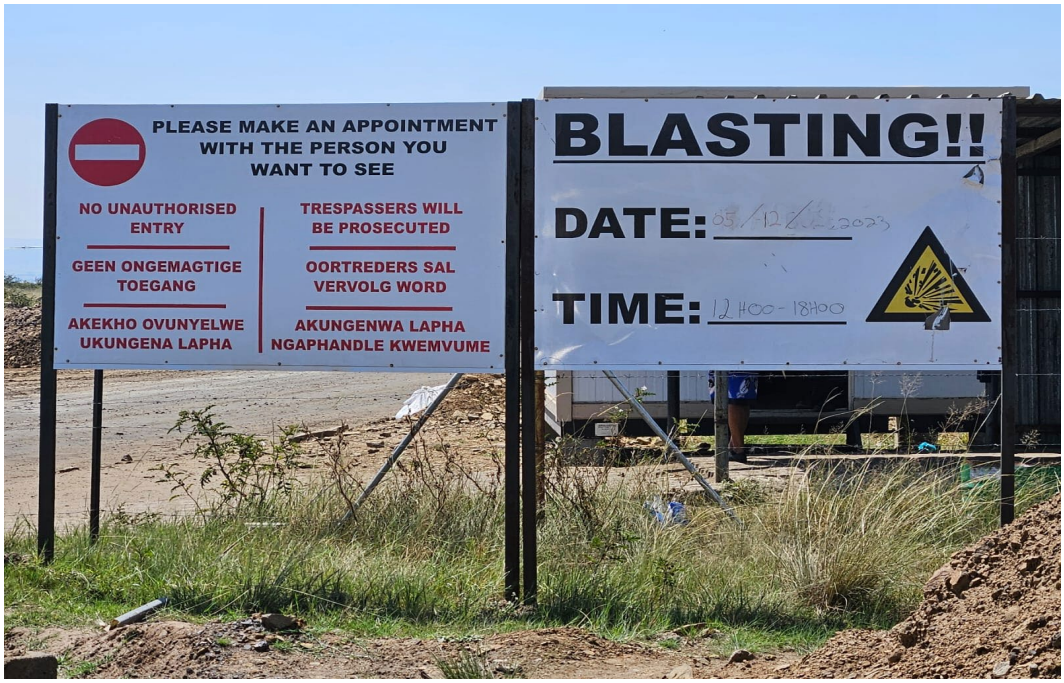


Figure 3: Blasting Notice Board at Shepstone Lake Colliery entrance (closer to the Mdutshwa Community)[45]



[45] There are two entrances to the Shepstone Lake colliery. The "official" entrance is quite far away from the community. There is no blasting notice board at that community. It should be noted though that when a community member wanted to log a complaint at this specific entrance, they were told to go to the "official entrance" more than a kilometre away. Upon arrival there, the person was told there is no complaints book or log, and they must proceed to the Kliprand Colliery gate (several kilometres away).

Similarly, on 20 February 2024, the blasting notice board at the entrance of the Kliprand Colliery indicated that blasting would take place on 24/11/2023 between 12h00 and 13h00. As with the blasting notice board at Shepstone Lake, the board remained unchanged on 16 March 2024.

The only notice given to affected communities is a vehicle, equipped with a siren, which according to respondents do not always make the rounds on blasting days. Whilst doing fieldwork in the community, both during February and March, no siren was heard prior to blasting.

- "There is the ambulance siren on a car that drives through the village, but it is feint and we don't really know is it an ambulance or the mine and it comes through many hours before the blast, so this is not an efficient system." [Woman, Kliprand Colliery, 13 February 2024]

- "We hear the siren, but it is very far, in the distance, we think it is at the mine. Occasionally a vehicle will come past with an ambulance siren, but there is a long wait between the time we hear and see the vehicle before the blast." [Young woman, Shepstone Lake, 15 February 2024]

- "That car that comes around with the ambulance sound, it does not always come. And sometimes it comes say at about 11am but then they blast only after 2pm. And it is not as if the noise from the car is continuous, it is only once. Young children and old people have already forgotten about the ambulance car, or we were not at home to hear to it, and then suddenly there is the blast with a big noise, the earth moves and the dust and the smell. It is terrible." [Man, Shepstone Lake, 15 February 2024]

- "We sometimes hear the siren, but it is most often feint, and it is not always that the siren is used to warn us. Even if the car drives around with the siren on, there is often hours between the siren and the blast. We do not know when the blast will happen." [Landowner, Mdutshwa Community, 15 February 2024]

- "This car with the ambulance siren, does not help. People don't take it seriously because they think it is an ambulance, and since they are not hurt, why would they pay attention. It is a ridiculous way to warn people about the blasts." [Woman, Shepstone Lake, 20 February 2024]

At the meeting with Ikwezi Mining in their Johannesburg offices on 01 March 2024, Mr Ndlovu said that they send out bulk SMSs to those community members whose

numbers they have. When asked in a follow-up question via email[46] as to the number of persons receiving the notices about blasting via SMS, Ikwezi Mining declined to provide this information. None of the persons participating in the research received any notices related to blasting, even though some of them received notices via SMS informing them that court action will be taken against them should they participate in any protests against the mine.

At the meeting on 01 March 2024, Mr Ndlovu also mentioned that a vehicle with a loudhailer is used to alert people in the community that blasting will happen. This was disputed by community members, who indicated that this was only used when households near Kliprand Colliery had to be removed from the 500m zone during blasting. Community members reported the following:

- "The experience of blasting is terrible. It makes people ill. The mine is not following the right procedures, they do not give people proper notice of the scheduled blasting. They certainly do not have a loudhailer with the car, it is just a siren similar to an ambulance siren and they do not send out SMSs. They might have done it in the beginning but not in recent times." [Ward Councillor, 15 March 2024]

- "Sometimes we hear the siren, but not always. There is no other notice about the blasts, only the car with the siren, but it is not always going around. They do not send SMSs out about the blasting. They could do that easily." [Landowner, 16 February 2024]

- "People don't know when the blast will come, there is no warning. It traumatizes people." [Mhlongamvula Kingdom Leader, 18 February 2024]

The teachers at the Shepstone Lake Primary School reported that they receive a note on the day of the blasting delivered to their school. This was confirmed by Mr Zulu, who represents the Emalangeni Traditional Council. Mr Zulu says he is informed about the blasting as well. He is informed personally by mine representatives.

- "The mine delivers a note here to us that tells us they are going to blast, and they give a specific time, but it is never at that the time stated on the paper. And this is bad, this anticipation of the blast, and then we have to wait and wait and when we just start to relax, then boom! It is so scary for the children and also for us. Our classrooms are shaking when they blast, and we are worried about the brick classroom, so we always bring all the children into the prefab classrooms because it is a bit safer." [Teacher, Shepstone Lake Primary, 19 February 2024]

[46] Initial email was sent on 7 March 2024, a reminder and more questions sent on 13 March 2024, 28 March and 10 April 2024.

At the meeting on 01 March 2024, Mr Ndlovu also mentioned that a "WhatsApp" is available for persons to consult. He declined to provide more information. At a community focus group discussion on 16 March 2024, community members explained that those who are in touch with the mine's CLO can see this person's WhatsApp status which sometimes updates on the blasting situation. This access to information is however limited to those who has regular telephonic contact with the CLO, those with smart phones and those who have access to data.

Severity of Blasting

The recommended blasting limits for structures is significantly greater than the comfort zones for people and animals. Humans and animals are sensitive to ground vibration and vibration of structures. Research[47] has shown that humans will respond to different levels of ground vibration. Ground vibration is experienced as "Perceptible", "Unpleasant" and "Intolerable" at different vibration levels for different frequencies. Humans already perceive ground vibration levels of 4.5 mm/s as "unpleasant", which results in people also assuming that any vibrations of the structure, e.g. windows or roofs rattling, will cause damage to the structure. Air blast also induces vibration of the structure.

Table 13: Human Response to Ground Vibration

Effects on Humans	Ground Vibration Level (mm/s)
Imperceptible	0.025 - 0.076
Barely Perceptible	0.076 - 0.254
Distinctly Perceptible	0.254 - 0.762
Strongly Perceptible	0.062 - 2.540
Disturbing	2.540 – 7.620
Very Disturbing	7.620 – 25.400

Source: Chiappetta, R.F. (2000) Vibration/air blast controls, Damage criteria, record keeping and dealing with complaints. The Institute of Quarrying, Southern Africa, Symposium, Durban

- "At the times when they are blasting, the wind direction is always in the community's direction" [Woman, Kliprand Colliery, 13 February 2024]

[47] Oriard, L.L. (1999) *The Effects of Vibrations and Environmental Forces*. Cleveland, OH, International Society of Explosives Engineers.
Chiappetta, R.F. (2000) Vibration/air blast controls, Damage criteria, record keeping and dealing with complaints. The Institute of Quarrying, Southern Africa, Symposium, Durban
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Siskind, D.E., V.J. Stachura and A.J Engler (1981) *Airblast Instrumentation and Measurement Techniques for Surface Mine Blasting*. US Bureau of Mines RI 8508.
Siskind, D.E., V.J. Stachura, M.S. Stagg and J.W. Kopp (1984) *Airblast and Ground Vibration From Contour Mine Blasting*. US Bureau of Mines RI 8892.

- “The blasting is not always the same. Sometimes it is just a loud bang without too many tremors, but sometimes you feel the ground vibrate first, then comes the bang, it is too terrible and then the smoke and the stink. It can make your eyes water.” [Man, Mdutshwa Community, 15 February 2024]

- “Sometimes they can feel the blast here at Shepstone Lake all the way at Kliprand. That is how terrible it is sometimes. The whole area shakes. When it is so bad, we get phone calls from those areas asking us if we are OK.” [Older Man, Mdutshwa Community, 15 February 2024]

- “Blasting is very scary. There is no notice, no schedule. Even with loadshedding we have a schedule, but not with the blasting. We can’t hear the car siren or any other siren from inside the clinic here. So it happens sometimes when we are working with needles or sharp instruments, and we can harm the patients. The building shakes terribly when they blast, but I have not as yet noticed any cracking. We really need them to send out an SMS and tell us the time they will blast so that we can be prepared.” [Sr Boshoff, Clinic, 16 February 2024]

- “We feel the blasts at our homes, even sometimes here at school. We can also hear it here at school, but it is feinter than when I am home near Kliprand, but the vibrations we feel here at school.” [Female high school student, Mnyamande High School, 20 February 2024]

A significant number of persons raised concerns about the gasses released during the blasting, most of these commenting on the smell.

- “After the blasts, I can sometimes smell the fumes. It is not just the dust that is in any case giving us sinus problems, but the fumes are different, it burns into the lungs.” [Teacher, Mata Primary School, 21 February 2024]

- “After the blast, that dust and fumes, it is bad. Some blasts are really bad, others not so much. When it is very bad, we can smell the fumes here.” [Teacher, Shepstone Lake Primary, 19 February 2024]

According to the participants in the study, there was only one incident of flyrock since Ikwezi started to mine there. This incident was at Shepstone Lake Colliery.

- “There was flyrock only once. The roof was thatched, and the rock fell on it and put it alight. The house burned. There was a lot of damage, but they got no compensation from the mine. It was only that one time when rocks flew far away into the air. We haven’t seen anything like that again.” [Man, Mdutshwa Community, 15 February 2024]

- “There has never been flyrock. The rocks shoot into the air, but do not land near us.” [Woman, Kliprand Colliery, 15 February 2024]

There was also consensus amongst all groups and key informants who participated in the study that although the blasting remains an irritant, the blasting outcomes (for the community) has been much improved since a different blasting contractor was appointed during the second half of 2023.

- “Things are much improved around the blasting since they changed the blasting contractor. The one who was here before, eish! It was bad. But this one that came last year, I think it was August, this one is much better. The vibrations are not so severe. I think they know what they are doing.” [Man, Kliprand Colliery, 13 February 2024]

Damage to Structures

Another common complaint was the damage to structures caused by the blasting.

- “The blasting is worrying us, there are now lots of cracks in our houses.” [Young woman, Kliprand, 13 February 2024]

As explained earlier in the report, the affected communities are rural and are located in a rural local municipality, classed as “Class B” municipality. Nearly all houses can be described as “houses of lesser proper construction” and “mud buildings”. Very few buildings in the area would be classified as houses of proper construction. These would include the community’s clinic and perhaps classrooms built in recent years. The recommended ground vibration limits are captured below.

Structure Description	Ground Vibration Limit (mm/s)
General Houses of Proper Construction	25 (USBM Criteria)
Houses of Lesser Proper Construction	12.5 (USBM Criteria)
Rural Building – Mud Houses	6 (USBM Criteria)

- “Look, you must understand, our communities are old and traditional, most of these houses that you see here were built decades ago and most people today might have a two-room brick house on their property, but the rondavels are the most important in our cultures. Those rondavels are mostly built from clay, the traditional way. The blasting from the mine, the tremors and vibrations, damage these rondavels. They crack.” [Man, Kliprand Colliery, 13 February 2024]

- “The worst part is when we are building new rondavels or fixing the old ones and it is raining and overcast, and so the mud is taking some days to dry properly. Then during this time, while the mud is still wet, the mine blasts, and the vibrations make the whole rondavel fall down. The mine does not think about how much time

and effort it costs to build here. They just want to blast, blast, blast and make money, while we suffer here." [Older woman, Kliprand Colliery, 13 February 2024]

- "I get many complaints about the houses cracking from the blasting." [Mhlongamvula Kingdom Leader, 18 February 2024]

- "I think the most complaints are about the cracking of the houses. I get so many of those complaints, which I pass on to the mine. I have not noticed that my house is cracking but I can feel the vibrations here at my house when they blast." [Induna, Mr Zulu, 16 March 2024]

- "This house is one year old, it is my second resettlement house from this mine, and it is already cracking from the blasting because the mine is still too close to us here. The ceiling boards come loose from the vibrations, and we always have to maintain them. It is a constant problem. At my previous house, the one they are now using for a security office, at that one I could hear the siren when they were going to blast, but here it is very feint. There I could always smell the fumes after the blast, but here only sometimes, it depends on the wind direction. At the previous house the flyrock would fall right in my yard, it was terrible. Then the mine would take us away in a bus to a tent and then give us some KFC and bring us back later. It was maybe safe for us, but I lost a lot of cattle during that time because my cattle would run away from fright every time they blasted and because I am an old woman I could not always get them all back and people would steal them. It was not good. Now at least it is better. But my lifestyle now is not necessarily better because I am living right next to the mine dump and it is not rehabilitated and the dust is terrible." [Mrs Nelesiwe Hadebe, 21 February 2024]

Some families had been resettled[48] by the mine from Kliprand Farm to an area close to where the Goedehoop Colliery now operates. The affected households claim that they are very close to the pit, which Mr Ndlovu disputed during the meeting on 01 March 2024 in Johannesburg. When Mr Ndlovu was requested[49] for information related to the

[48] Resettlement as part of mine development and/or mine expansion is frequently unavoidable, particularly in the instance of surface mining. However, responsible mining companies would normally ensure that resettlement needs only happen once during the Life of Mine and that the resettlement serves its purpose, i.e. a household relocated in a safe space away from the mine and its associated harms, and that the household is provided with all the support the household requires to re-establish their lives and livelihoods. In order to address the poor execution of resettlements in the country, the DMRE published guidelines for mine community resettlement in March 2022. Unfortunately, Ikwezi Mining's historic and current resettlement processes do not align with these guidelines.

[49] Question sent via email on 07 March 2024: Could you please let me know the exact distance between Goedehoop and the two Hadebe families residing nearby? These families were relocated there from the area where the Kliprand mining area is currently.

distance these families are located from the Goedehoop Colliery, he declined to provide same.

- "We were resettled here but now we are very close to the Goedehoop colliery. Why did the mine put us here and then open a pit so close to us? We feel the vibrations first before we hear the bang. Sometimes we can even smell the fumes after the blast, depends on the wind direction. But our house is cracking already. It is from all this blasting and tremors. Sometimes the blasting is very bad, it feels like the whole house will collapse. Other times not. We can hear the siren from the pit. It is loud and it goes off every time they blast, so it is a good warning. It goes for at least 30 minutes before the blast and a few minutes after." [Mrs Hlaleln Hadebe, 21 February 2024]

- "The blasting is very hard on us. The mine resettled us here and now we are so close to Goedehoop and the vibrations are so strong here. At least here we are lucky, we can hear the siren from the mine, it helps us prepare a bit for the shock that will come. I've seen flyrock, but it is far away, not near to us." [Mrs Pumelele Hadebe, 21 February 2024]

It was noticed that prefabricated buildings, e.g. classrooms, whilst still swaying when blasting happens, suffer less damage than brick or mud structures. Empirical data from Bauer and Calder (1977)[50] confirms that these buildings have better tolerance for ground vibrations.

Table 14: Vibration amplitudes for structures and equipment

Type of Structure	Type of Damage	PPV at which Damage Starts (mm/s)
Rigidly mounted mercury switches	Trip-out	12.7
Concrete blocks such as floor slabs	Hairline cracks in concrete	203
Cased drill holes	Horizontal offset	381
Mechanical equipment such as pumps and compressors	Shaft misalignment	1016
Prefabricated metal buildings on concrete pads	Cracked floor, building twisted and distorted	1524

Source: Bauer, A., & Calder P. (1977) *Pit slope manual*. *Chapter 7 – Perimeter blasting*. Energy, Mines and Resources Canada, CANMET Report 77-14. Ottawa, ON, Canada. Page 82.

There were a few complaints of windows cracking or shattering.

[50] Bauer, A., & Calder P. (1977) *Pit slope manual*. *Chapter 7 – Perimeter blasting*. Energy, Mines and Resources Canada, CANMET Report 77-14. Ottawa, ON, Canada. Page 82.

- "Once the blast was so strong that three of our windows cracked." [Teacher, Mwethu High School, 21 February 2024]

At the meeting on 01 March 2024 in Johannesburg, Mr Ndlovu disputed this assertion by the school, indicating that it is not true. It must be noted though that the seismographs from April 2022 indicates that Kliprand Colliery exceeded air vibration standards in April 2022.

Table 15: Incidents when blasting exceeded air vibration USBM standards at the Kliprand Colliery during April 2022

Date	Time	Seismograph location	L-PPV	T-PPV	V-PPV	L-Freq	T-Freq	V-Freq	R-PPV	Air Blast
22/04/2022	12:14	Point 02	0.19	0.14	0.20	23.27	8.00	32.00	0.26	120.3
28/04/2022	15:09	Point 01	0.34	0.35	0.90	8.98	13.84	18.96	0.90	140.6
28/04/2022	15:09	Point 02	0.58	0.21	0.89	21.33	30.12	34.13	1.01	140.2
28/04/2022	15:09	Point 03	0.37	0.24	0.39	32.00	23.37	19.69	0.52	133.1

Source: Blast Management & Consulting

Windows are normally damaged by air blasts.

When Mr Ndlovu was asked[51] to make seismograph readings for the Shepstone Lake Colliery available, he declined.

Effects on Women

The women complained mostly about the dust[52] from the mine, which mostly came from the trucks transporting coal through their villages and specifically from the wash plant, more so than from the blasting impact; the sinus problems which they and their children are developing and the constant manoeuvring of heavily laden coal trucks via the communities. Blasting, however, does come with a burden on women as well.

- "The levels of stress due to the blasting and all the other things to do with this mine, is terrible. Many women have to constantly worry about their children, they even blast during school times. They have no respect this mine." [Woman, Mdutshwa Community, 15 February 2024]

- "I was walking in the veld, when suddenly the blast came. It threw me down on the ground, and I hurt myself. My leg was sore for a long time afterwards. While I

[51] Question via email on 07 March 2024: "With the community complaining of more noise and vibrations coming from Shepstone Lake compared to the other pit/s, would you be willing to make the seismograph reading from Shepstone Lake available?"

[52] Whilst this study was looking specifically at the impacts of blasting, one cannot ignore the impacts on women specifically of living with a constant layer of dust from other non-blasting mining activities, e.g. coal dust from the wash plant and the constant transport of coal on open trucks through their communities. The burden of living with constant dust for women include the need to constantly clean, which uses time they would otherwise use for other more productive activities, the worry about the cleanliness of food and stored drinking water, and the worry about their and their loved ones' health due to breathing in coal dust.

was lying there after the blast, I could smell the gas in the air. It was burning my eyes." [Older woman, Mdutshwa Community, 15 February 2024]

The experiences of these women point to the psychosocial impact of opencast mine blasting. Due to the blasting, and specifically, the lack of adequate blasting notices, increases manyfold the normal worry a mother or caregiver might have for their children and loved ones.

Psychosocial impacts[53] are those impacts arising from unwanted changes that specifically relate to mental health, psychological wellbeing and emotions of people. These unwanted changes can include a change in their feelings of security, i.e. they feel that they are no longer safe in their home and community; a change in their feeling of belonging; and a change in a sense of place.

The Theory of Environmental Turbulence (TET)[54] posits that people's lives are immersed in a cumulative surround, which is experienced as normalcy, around which thoughts, understandings and expectations (i.e. 'lifescapes'), patterns of behaviour (i.e. 'lifestyle') and psychological balance (i.e. 'lifestrain') are organised. When this normalcy is shattered, by, for example, mine blasting, if affects the person's lifescapes, lifestyle and lifestrain. The impact of this can range from feeling annoyed, inconvenienced, anger through to feeling helpless and developing debilitating conditions and suffering significant trauma. All of these emotions were displayed by women community members who participated in this study.

Impacts on Youth and School Children

In its founding affidavit in its case[55] against Tendele Coal Mining (Pty) Ltd, the Mfolozi Community Environmental Justice Organisation's representative, describes the impact of blasting at Somkhele Mine, an opencast coal mine near Mtubatuba in KwaZulu-Natal as follows:

"*I know what it is like to be in close proximity to a mine when they blast the ground apart. The sound is terrifying, but what is even more scary is the impact of the air vibrations on a person's lungs and the shaking of the ground. It feels as though you have*

[53] See also: Edelstein, M.R. (1986) *Toxic exposure and the inversion of home*. Journal of Architecture and Planning Research, 3(3), 237–251.
Edelstein, M.R. (1988) *Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure.* Boulder, CO: Westview Press.
Edelstein, M.R. (1991) *Ecological threats and spoiled identities: Radon gas and environmental stigma*. In S. Couch & J.S. Kroll-Smith (eds), *Communities at Risk: Community Responses to Technological Hazards*. New York: Peter Lang, 205–226.
Edelstein, M.R. (2003) *Weight and weightlessness: Professional versus paradigmatic issues in weighing the psycho-social impacts of proposed environmentally hazardous facilities in the administrative law process*. Impact Assessment & Project Appraisal, 21(3), 195–203.
[54] TET was developed by Michael Edelstein from the emergent findings of his early work on psychosocial impacts.
[55] Case No 3518/23P in the High Court of South Africa, KwaZulu-Natal Division, Pietermaritzburg

fallen hard on the ground and winded yourself. Windows rattle and crack. I am an adult man, and I find it scary. I do not want to imagine what the poor primary school and creche children will feel like when they are so close to this occurring. They should not have to suffer through this at all." (Paragraph 284)

The affidavit, in paragraph 285, further mentions an article which described the experiences of children exposed to opencast blasting. The article[56] states as follows:

> "*The 56 children aged between 0 to 5 years old were struggling to concentrate during their lessons and activities because of the noise and vibrations coming from the mine.*
>
> *'Since the mine came, things have changed a lot. We had to monitor children more than we did before because they would sometimes pick up debris that get scattered all over after blasting activities,' she added.*
>
> *Even though the aftermath of the aftermath of the blasting activities was a concern, it was the reaction of the children before and during the blasting that the teachers were more concerned about.*
>
> *For the children's safety, the teachers had gotten used to preparing them mentally before the blasting could happen.*
>
> *Preparation for the traumatic and confusing activities would start the day before when an official from the mine would come to inform them that there was a scheduled blasting activity for the following day.*
>
> *This always made the teachers anxious because they had seen how the children reacted to the loud noise, tremors and not being able to play outside.*
>
> *'First you will hear the siren alerting us that the blasting is about to start and then the mayhem starts. Then there will a huge explosion which makes the ground shake, following by a huge cloud of smoke and dust,' said the teacher.*
>
> *She added that: 'Some of the children just freeze and others start crying. We try to calm them down until the noise is gone. We also do not allow them to play outside on the day because there will be a lot of dust and everything just looks black.'"*

In the communities affected by Ikwezi Mining's operations near Danhauser, the impact of the blasting, particularly the inadequate warning system in place, also has the most profound negative impact on the children of the communities.

- "They blast even during school hours, with no warning. This is particularly bad for the primary school children and those in the crèche." [Teacher, Sipumelele Creche, 13 February 2024]

[56] The Alex Report dated 8 November 2022 (published online)

- “The blasting is terrible for the children. They will start to cry and run into the house. Sometimes the shock is so much that they wet themselves.” [Old woman, Shepstone Lake, 15 February 2024]

- “There was a baby crawling outside in the yard when there was a blast. The child went into some type of attack from the shock. He could not breathe properly afterwards. The babies and young children are all traumatized from this blasting.” [Man, Mdutshwa Community, 15 February 2024]

- “Children’s mental health is suffering. My young child, when she hears the car with the ambulance sounds, she already starts to cry from fear. She has become a clingy, scared child, always afraid, always waiting for the blast.” [Young woman, Mdutshwa Community, 15 February 2024]

- “When they blast, the classroom shakes terribly. The children cry, especially those who are younger, they get very scared. When I hear the siren from the mine, I know they will blast soon, then I take the children outside to rather stand outside away from the classroom because I am afraid that the building will collapse on the children because it shakes terribly.” [Crèche teacher, Mbabane Cash Farm, 16 February 2024]

- “The blasts scare us a lot. It scares both the teachers and the children. There is no notice or warning when the blasts will happen, suddenly there is just the blast. And it is very traumatizing for the children. It is particularly bad because these children can no longer distinguish between thunder and the blasts. When they hear thunder, they already start to shake and cry because they think it is going to be a blast with the vibrations, and dust and terrible smell in the air. Even the school’s governing body has engaged with the mine and informed the mine of how the blasting is affecting the children, but it made no difference.” [Mr Tshabalala, Embabane Primary School, 19 February 2024]

- “The blasting is really a big problem for our children. There is one child who lives very close to the mine. That child is very traumatized from the blasts and needs counselling. But to be honest, us as adults also need counselling. It is like living in a war zone with this mine and the blasting.” [Teacher, Shepstone Lake Primary School, 19 February 2024]

- “They blast during school time, but they do not let us know. We cannot prepare the children. The children are all so traumatized because the blasts are so

sudden. There is a lot of crying, especially the smaller ones." [Teacher, Mata Primary School, 21 February 2024]

- "The blasting is really devastating. We can see the primary school from here and when they blast we can see the little ones running out of the classrooms from the fright, screaming and crying. Why don't they warn the teachers about the blast, then the children can be prepared? It would be so easy to do. A whole generation is being traumatized unnecessarily here." [Teacher, Mwethu High School, 21 February 2024]

Despite some adult community members complaining of sinus and eye infection problems, the local government clinic has not noticed a sharp increase in these and respiratory illnesses in the communities.

- "We monitor and keep track because we are all aware of the health-impacts of coal mining on people living so close to the mine, but to date there has been no sharp increases in respiratory or eye diseases which we could link to the coal dust coming from the mine. This is the case for both adults and children. Of course the cumulative impact of breathing in this coal dust in the air will before long rear its head in these communities as they have done in those exposed to opencast coal mining in Mpumalanga. It is only a matter of time." [Sr Boshoff, Clinic, 16 February 2024]

Cultural Impacts

The Shepstone Lake area is highly significant to the people of the Mdutshwa Community. They consider it to be a holy place. The significance of the area goes beyond just the lake, but also the area where the Shepstone Lake Colliery is currently operating. The community members expressed concerns that there was no ritual done to ask permission from the spirits and ancestors to disturb the ground there.

- "The area we used for the type of ritual ploughing called *Nomkhubulwane* is now unreachable, it is surrounded by huge sand mounds, the mine dumps. We would go to this place to pray for rain, but the fences make it impossible to reach there now. Our children who are supposed to do *Nomkhubulwane* are afraid to go near there now because of the blasting.

  Because there was no ritual done, whenever they do blasting there, bad weather already happens. This will get worse. Strong winds together with rain will come and blow our homes away and destroy everything.

  We as the people of the community know of a message received by one of the community's traditional healers as a warning that said should the mine continue

to blast even worse weather will come. There will be heavy rain and wind, but even severe drought can also come.

Our grandfathers were taught by their grandfathers that in order for us to live, we will have to till the land and plant vegetables for food to eat and we must keep livestock to sell when we need money for things we need to buy. Near Echibi (Shepstone Lake), there a variety of wildlife thrives and around the lake we find ducks, swans, geese and many creatures in the water and under the water. Even our cattle, goats and sheep used to drink from this wonderful source called Echibi. But now, lately, the animals are getting sick and are dying because of the chemical that are being used by the mine so close to the lake.

In the year 2014, a ceremony was held. We slaughtered cows as an offering unto the ancestors of this place. This was necessary because people were not obeying our ancestors and the rules of Echibi and the lake was no longer healthy. The ritual helped us to restore the health of the lake, but it also made the people aware again of the important role the lake plays in our lives.

And now it is all being undone by the ongoing mining activity. They have already dug up the ground, which is not allowed. The soil of this place cannot be dug up and removed. And in the place where the mine is currently working, no vehicles or anything using wheels is allowed a certain point in order to keep the area a holy and sacred place.

The one thing that pains me the most about this whole situation, the people who are involved in these mining operations have no idea as to the dangers they might face because they have not asked permission from our ancestral kings, a ritual was not done. If this is not done, with time, people are going to be injured and possibly even death will occur as punishment for disturbing this holy place of Echibi." [Sangoma, Shepstone Lake, 18 February 2024]

At the meeting on 01 March 2024 at Ikwezi Mining's offices in Johannesburg, Mr Ndlovu indicated that the company would be willing to carry the costs of such a ritual. However, when this undertaking was conveyed to the leader of the community, he indicated that they do not trust the company and that many lies had been told to them by the company in the future. Before any ritual can be conducted, the company must adhere to the promises it made to the community, starting with the implementation of the SLP projects.

Grievance Mechanism

The United Nations Guiding Principles on Business and Human Rights stipulate that: "Business enterpises should respect human rights. This means that they should avoid

infringing on the human rights of others and should address adverse human rights impact with which they are involved" (pg. 13). Where a company identifies a situation where human rights are infringed upon and where communities are aggrieved by the activities of the company's operations, it is the responsibility of the company to ensure that there are means provided for communities and other stakeholders to raise their concerns or human rights violations identified through a grievance mechanism.

Responsible mining companies have well-developed complaints and grievance procedures, which allow those affected by the company's operations to easily access remedy where appropriate. The five main principles[57] incorporated in best practice grievance mechanism are:

1. Proportionality: A mechanism scaled to the risk and adverse impact on affected communities.
   The scope, form and level of complexity of a grievance mechanism should be proportionate to the potential adverse impacts on and interaction with local and/or host communities. If the groups affected are diverse, or the impacts on them severe, the nature of interaction can pose serious challenges even where the number of people is relatively small. Therefore, the mine's social and environmental footprint, as well as social sensitivity, should be taken into consideration.

   Opencast mine blasting is considered to have the potential to have severe adverse impacts on the affected communities. It is thus essential that procedures to lodge, adjudicate and settle complaints related to injuries to humans, pets and livestock; as well as damage to infrastructure and other property be detailed in the grievance mechanism.

2. Cultural Appropriateness: Designed to consider culturally appropriate ways of handling community concerns.
   - Seek input on culturally acceptable ways to address complaints and grievances from significantly different groups within affected communities, including different ethnic of cultural groups within the mine's footprint.
   - Understand cultural attributes, customs and traditions that may influence or impede their ability to express their grievances, including differences in the roles and responsibilities of marginalised groups, and cultural sensitivities and taboos.

[57] IFC (2009) *Good Practice Note: Addressing Grievances from Project Affected Communities.* World Bank, Washington D.C.

- Agree on the best way to access grievance mechanisms, taking into consideration the ways communities express and deal with grievances.

3. Accessibility: A clear and understandable mechanism that is accessible to all segments of the affected communities at no cost.
   Grievance procedures should present no (or very low) barriers to access by affected communities, otherwise communities are less likely to use it. Thus the mechanism should:
   - Use clear communication: easy-to-understand information about the grievance process and how the mechanism works; and
   - Ease to use: simple, convenient, culturally appropriate means for filing complaints, at no cost to complainants.

4. Transparency and Accountability to All Stakeholders
   Complainants have the right to be heard, taken seriously, and treated fairly in a consistent and predictable process. It is also a process that allows the affected communities to hold the company accountable.

5. Appropriate Protection: A mechanism that prevents retribution and does not impede access to other remedies.
   Affected communities should be encouraged by the company to share their concerns freely, with the understanding that no retribution will be exacted for participation. A mechanism free of retribution will consider potential dangers and risks to complainants and incorporate ways to prevent harm. These precautions include a clear policy of non-retaliation, measures to ensure confidentiality and physical protection of complainants, safeguarding of personal data collected concerning a complaint, and an option for complainants to submit anonymous grievances where necessary.

The Centre for Applied Legal Studies[58] also indicates the following (on pg.24):

- All affected parties should play a role in deciding on the procedure to be followed in the event of a grievance.
- Communities pursuing a complaint through an independent grievance mechanism should have access to specialists to enable them to engage on an equal footing with mining companies.

[58] Centre for Applied Legal Studies (2019) *Best Practice Guidelines for Mining in the SADC Region: Towards an inclusive and sustainable approach*. Open Society Initiative for Southern Africa

Ikwezi Mining has not published a grievance mechanism, and thus one is unsure whether it exists and to what degree it complies with best practice.

The most common complaint related to damage of buildings and other infrastructure due to blasting is that there is no feedback from the mine once a complaint has been logged. At the 01 March 2024 meeting in Ikwezi's Johannesburg offices, Mr Ndlovu said the company has a well-developed grievance mechanism which is easily understood by the community and utilized by them. He indicated that any community member can write in the 'complaints book' kept at the gates of all the collieries. These complaints are then followed up by relevant people at the mine. He declined to provide further information requested.[59]

On 16 March 2024, a community member went to the Shepstone Colliery gate nearest to the community and asked the security guard for the complaints book. The security guard said there is no such book and referred the community member to the other gate, more than a kilometre away. Once there, the community member was told there is no complaints book and they should proceed to the Kliprand Colliery gate, several kilometres away. Once there, there was no sign of the complaints book, but the community member was given a loose sheet of paper on which to write their complaint with an undertaking by the person in charge that a relevant person will be in contact on Monday, 18 March 2024. Unfortunately, no-one contacted the community member since then.

Baseline (Pre-blast) Survey

A pre-blast survey[60] is a detailed record, accompanied by video and photographs of the condition of private and public property and structures prior to the commencement of blasting operations. It is important that the pre-blast survey be conducted by an independent consultant specialising in the field of blasting vibrations and their effects on structures, rather than a mine employee. During such a survey the structure's foundation, all walls, doors and windows should be checked. It is essential to document the location, length and width of any cracks or deficits both in the interior and exterior of the structures. Just as important is noting where there is no damage. Where they occur, water wells should also be checked prior to the commencement of blasting. The pre-blast survey report should include written notes, backed-up by photographic evidence; as well as video and audio recordings that evidence the survey process. The owner must be provided with a copy of the report.

[59] Question asked via email on 07 March 2024: "You described the grievance mechanism as it is implemented by the mine. Is there a written grievance mechanism available? Would you be able to tell me how many blasting-related grievances there were in the last year and how these were resolved?"

[60] Please also refer to sections 9.7.4 and 9.7.5 of the 2016 Mine Health and Safety Council report on *Development of a South African Minimum Standard on Ground Vibration, Noise, Air-blast and Flyrock near Surface Structures to be Protected*.

A new survey should be conducted when more opencast colliers nearby are developed[61] and/or if any alterations or extensions are made to the structures and or household compound.

A post-blast survey must be conducted once a complaint is lodged. The procedures for the lodging of a complaint should be detailed in the company's grievance mechanism and it should emphasise that a complaint must be lodged within a reasonable time after the blast that is suspected of causing the infrastructure damage. During the post-blast survey, the damage must be inspected, documented and photographed; and then compared with the pre-blast survey report. It is essential that the post-blast survey must also be conducted by an independent consultant specialising in the field of blasting vibrations, and not a mine employee.

Ikwezi undertook a baseline, pre-blast survey[62] of homestead buildings prior to commencing the mining activities. Most participants in the study said that the mine only took photos from the outside of their houses and not from the inside as well. Photographs were also only taken at one time, there was not a repeat of the exercise to establish whether houses are deteriorating from the impact of the blasting.

- "The mine started to blast already when they were doing exploration. During that time there was already damage being caused to my house. They then came here long after and took photos only from the outside of my house. They never came in to check the damage on the inside." [Older woman, Mdutshwa, 18 February 2024]

- "Yes, I can remember they came to our house, my parents were still alive, and they took photos, but my father was not home, so my mother did not let them in into the yard. She asked them to come back when my father is at home, but they never came back." [Young woman, Kliprand, 19 February 2024]

Mr Ndlovu disputed this and said all houses were photographed from both the outside and the inside. When asked[63] if, with permission from the homeowner, one could have a look at the photographs of that specific house to verify what is the truth, Mr Ndlovu declined.

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[61] As has been the case with Ikwezi Mining, which had at the time that this study was conducted, three collieries operating within a few kilometres from each other but most of the pre-blasting surveys were only conducted when the Kliprand colliery (the first of the three) was developed.

[62] As per the EMPr: "Together with the vibration surveys, a visual census may also take place. Photo's (*sic)* of structures in and around the mining area will be taken and retaken after blasting has occurred and a few weeks thereafter where required. Such a survey will illustrate the possible damages caused by mining activities and blasting." (Pg. 40)

[63] Question per email sent on 07 March 2024: "The blasting baseline data, which was collected, and community members claim only the outside of the houses were photographed: would it be possible for me to see this data to verify that the company had taken photographs on the inside of the houses as well, and that the household heads have signed these forms? If necessary, I can get permission from community members to inspect their specific forms. Please advise."

Other General Issues

Lack of in-depth consultation on issues plagues the mining industry and the Ikwezi-affected communities said that the mine sporadically holds community meetings but often on days when it is inconvenient for most people. The Mdutshwa Community indicated that only one community has been held related to the Shepstone Lake Colliery and it was on a day when most people needed to travel to Newcastle.

Mr Ndlovu disputed this but declined to provide clarifying information[64] related to community meetings and consultations.

At the height of mining at the Kliprand Colliery, the mine routinely removed people residing within the 500m zone to a safe area away from the mine during blasting. They also closed the R34 for the duration of the blast. Questions related to this practice sent to Mr Ndlovu via email on 10 March 2024:

(i) When was the last time that it was necessary to blast within the 500m zone which requires the mine to evacuate the residents within the zone for the blasting period?

(ii) Also, could you perhaps share copies of the blasting permits issued by the Chief Inspector/Mine Health and Safety Inspectorate blasting within 500m from houses or public infrastructure?

Mr Ndlovu declined to provide this information.

Conclusion

Despite the other impacts of Ikwezi's mining operations, which include dust (both normal dust from gravel roads and coal dust), heavy coal mine trucks traversing through their communities, damaging roads; the shrinking availability of grazing land as the mining activities expand; and social ills such as older men preying on young school girls; blasting has a profound impact on these communities.

The inadequate notice system for blasting, which is exacerbated now that the mine is blasting from three pits, often on the same day, adds to the trauma experienced by the old, the sick and the very young who are unable to prepare physically and psychologically for the impact of the blast (whether ground vibrations or an air blast or a loud bang, or all three).

[64] Question sent via email on 07 March 2024: "Dates of community meetings when blasting was discussed (whether at Kliprand, Shepstone Lake, and/or Goedehoop). It would also be helpful if you could indicate approximately how many persons and/or households attended each of the meetings and what particularly, related to blasting and its effects on the community, was discussed and what was concluded; and whether any mitigation action was decided on and subsequently undertaken."

The blasts from three opencast collieries/pits on the same day can have a detrimental effect on both the people living there, the livestock, as well as the houses. The area is rural and thus most of the structures are not built to the level of proper construction. There has never been a need to do so. The company's inadequate baseline pre-blasting survey, which is not repeated at regular intervals to monitor the impact of the blasting on the structures, compounds the concerns of the communities. There also appears to be no professional grievance mechanism nor a professional and effective manner to deal with the communities' concerns, grievances or damage claims.

The impacts of Ikwezi Mining's blasting in its three collieries near Dannhauser, as described by members of the communities living near the collieries, can be summarized as follows:

Psychosocial Impacts:

- Signs of trauma in young children and the aged;
- Community members no longer feeling at peace in their homes;
- Community members, particularly women, are worried about the safety of their children and loved ones;
- Community members are worried about their homes and whether the walls, which are cracking, can withstand the next blast;
- Teachers and nurses worried about the children and patients in their care;
- Teachers, particularly those teaching at school located close to the colliers, are worried that the classrooms will collapse on top of the children during, and in the aftermath of, a blast.
- Feelings of anger in some community members, which has found expression in demonstrations against the company; whilst particularly the older community members expressed a 'helplessness'. This impact is exacerbated by the lack of a functioning grievance mechanism.
- The changes in the landscape, from rolling green hills to mine dumps and mine dust turning grass black around the wash plant, also significantly affects the communities, especially the older community members, who report their sense of place, belonging and wellbeing in connection to the biophysical space being negatively impacted by the blasting and the transformation of the landscape.

Cultural impacts:

- The destruction of the area around the Shepstone Lake has had a lasting impact on the community's cultural beliefs and spiritual connection to its sacred places.

Economic impacts:

- Buildings cracking or collapsing (especially if the owner is still busy building) has significant negative economic impacts on the community. This is exacerbated by the non-functioning grievance mechanism, which results in few claims against the mine being investigated and even fewer settled.
- Livestock runs away during blasts, resulting in hours wasted looking for them, time which could be used for more productive activities.
- When livestock runs away during blasts, they are sometimes injured and die; or are stolen, which results in losses for the owner.
- The reduction of safe grazing areas for livestock.

Productivity:

- When people are moved out of the 500m zone, they lose up to three hours of productive time, in which they are unable to conduct their normal activities.
- Physical injuries from, for example, falling when the blast suddenly happens, also results in loss of productivity, loss of income and can result in the loss of health.

Recommendations

The following recommendations are based on my expert opinion as a sociologist with 30 years' experience, 20 of those in the mining industry:

- Education, information and training: Government should ensure that the ongoing trauma experienced by young children living in opencast mine areas be addressed urgently. Government, the Minerals Council, and Ikwezi Mining could play a constructive role in this effort by creating a roadshow to all the schools in the affected areas and explain to the children, at a level appropriate to their ages, the different aspects of mining and what happens when a mine blasts. Very often the trauma is reduced when children (and adults) understand the process involved in mining. In this regard, NEMA specifically provides an imperative that "*Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means*."[65]

- Public participation and communication: The mine should improve its communication with communities impacted by the mine's activities. For instance, blasting notices should be sent out to community members, including those working at schools and the clinic who might not reside in the

[65] NEMA section 2(4)(h)

communities but who work in the community, via SMS notifying the households of which colliery will blast and when. Such SMSs should be sent at least 48 hours in advance of a proposed blast. The time-frame in which the blast occurs should be minimised to two hours, thus: a blasting notice should indicate as follows: "Blasting at Shepstone Lake on Thursday, 4 July 2024 between noon and 14h00", instead of "Blasting at Shepstone Lake on Thursday, 4 July 2024 between noon and 18h00". There should also be blasting notice boards in the community, e.g. at the Banana Supermarket's bus stop which is frequented by nearly everyone affected by the company's operations, at the clinic and at other spaza shops in the various communities. These should be updated daily.

- Blast shockwave mitigation and timing: The mine should make every attempt to minimise ground and air vibration shockwaves generated by blasts.[66] Similarly, the mine should make all attempts to reduce dust and fume emissions, as well as flyrock. Blasting operations at the collieries should only be conducted between two hours (for example between noon and 2pm) and these hours should be known in the surrounding areas and communicated well in advance to affected communities.

- Transparency and access to information: When permission to blast within 500 meters from community infrastructure is required, the mine should have a standard process as to how it conducts the required consultations with affected community members. Similarly, the mine should have a standard process for how the required risk assessment is conducted. These processes should be provided to the communities impacted by mine blasting in an open and transparent manner. Blasting permits granted by the Principal Inspector of Mines should be available upon request by affected community members without requiring an application under the Promotion of Access to Information Act for all permits issued to it to blast. These permits could also be posted on Ikwezi Mining's website. The mine's health and safety policy should also be available upon request to any community member and published on its website.

- Grievance Mechanism: Ikwezi Mining should develop, implement and maintain a functional grievance mechanism as soon as possible. It is vital that the grievance mechanism should detail the processes that must be followed by both the mine and the affected household when there are claims of damage to property as a result of the mine's blasting activities. The grievance

[66] For instance through technological advancements, explosive selection and blast design.

mechanism and its processes should be known to the affected communities and should also be published on the mine's website for easy access.

- Suitable blasting standards: Government should formalize blasting standards suitable for South African rural and traditional communities. The Minerals Council should participate in contributing to these important discussions.

- Care of duty: It is also important that more work be done in examining the application and use of NEMA's duty of care in the context of blasting operations.

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