dBAcoustics

Tel.	**+27 11 782 7193**	**PO Box 1219**
Fax	**+27 11 782 7193**	**Allensnek**
Cell	**+27 82 922 0298**	**1737**
E-Mail	**barendv@xsinet.co.za**	
Website	**www.dbacoustics.co.za**	

Sishen Iron Ore Company (Pty) Ltd Environmental Noise Impact Assessment – DMS Upgrade Project for the Processing of Low Grade Iron Ore Material.

Kathu, Northern Cape

Project No: 016/2018
Compiled by: B v/d Merwe
Date: 5 February 2018

DECLARATION OF INDEPENDENCE

I, **Barend J B van der Merwe,** as duly authorised representative of **dBAcoustics**, hereby confirm my independence and declare that I have no interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which **EXM Advisory Services** was appointed as Environmental Assessment Practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act) for the **compilation of a professional opinion of the DMS Upgrade Project – Sishen Iron Ore Company (Pty) Ltd, Kathu, Northern Cape**. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it. I have disclosed, to the environmental assessment practitioner, in writing, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act. I have further provided the environmental assessment practitioner with written access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not. I am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2014 and any other specific and relevant legislation (national and provincial), policies, guidelines and best practice.

Signature: 

Full Name: Barend Jacobus Barnardt van der Merwe

Date: 5 February 2018
Title / Position: Environmental noise and vibration specialist
Qualification(s):\ MSc Environmental Management
Experience (years/ months):15 years
Registration(s): SAAI, NACA, IAIASA and SAIOH

Details of specialist and expertise

I, Barend JB van der Merwe of 43 6th Street, Linden Johannesburg have been an environmental noise and ground vibration specialist for the last 15 years. I have been instrumental in the pre-feasibility studies of proposed projects which may have an impact on the environment and noise sensitive areas. I am also involved with the noise and ground vibration impact assessments and the environmental management plans compilation of large projects such as wind farms, mining, roads, trains (primarily the Gautrain) and various point noise sources. As a post-graduate student in Environmental Management at the University of Johannesburg, I obtained an MSc degree with the research project concentrating on the impact of noise and ground vibration on a village close to a new underground mine. I have played a major role in the identification, evaluation and control of physical factors such as noise and ground vibration in the following projects – wind farms, various platinum and coal mines and the quarterly noise evaluation of the Gautrain, the decommissioning of the N11 near Mokopane, construction of the P166 near Mbombela, design of the Musina by-pass, noise mitigatory measures at the N17 road near Trichardt, establishment of the weigh bridge along the N3 near Pietermaritzburg, George Western by-pass. The following large environmental companies are amongst my clients: Gibb, Royal Haskoning DHV, Coffey Environmental, Golder Associates Africa (Pty) Ltd, GCS Environmental (Pty) Ltd, Globesight Environmental Consulting, Knight Piesold Environmental (Pty) Ltd, MattMcdonold Engineering (Pty) Ltd and SRK Engineering (Pty) Ltd.

Qualifications

1. MSc Environmental Management – University of Johannesburg;
2. BSc Honours in Geography and Environmental Management – University of Johannesburg;
3. National Higher Diploma in Environmental Health - Witwatersrand Technikon;
4. National Diploma in Public Health - Cape Town Technikon;
5. National Certificate in Noise Pollution - Technikon SA;
6. National Certificate in Air Pollution - Technikon SA;
7. National Certificate in Water Pollution - Technikon SA;
8. Management Development Diploma - Damelin Management School; and
9. Advanced Business Management Diploma - Rand Afrikaans University.

Membership

- South African Institute of Acoustics (SAAI);
- International Association of Impact Assessment (IAIA);
- National Association of Clean Air (NACA);

- South African Association of Geographers (SAAG);
- South African Institute of Occupational Hygiene (SAIOH).

Experience

- Noise impact assessment of different mine establishments;
- Noise Control Officer i.t.o. Noise Control Regulations;
- Compilation of noise management plans;
- Annual and quarterly baseline noise surveys;
- Moderator Wits Technikon – Environmental Pollution III.
- Various road projects for SANRAL.
- Compilation of the Integrated Pollution strategy for Ekurhuleni Town Council.
- Represent clients at Town Planning Tribunals.
- Represent clients at Housing Board tribunals.
- Determine residual noise levels in certain areas as required by clients.
- Noise attenuation at places of entertainment.
- Design and implementation of sound attenuators.
- Noise projections and contouring.
- Advisory capacity regarding noise related cases to local authorities: - Sandton, Roodepoort, Randburg, Krugersdorp, Alberton, Centurion, Vereeniging. Due to my previous experience in Local Government I provide a service to these Local government departments on the implementation of the Noise Control Regulations and SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to land use, health annoyance and to speech communication.
- Identification, Evaluation and Control of noise sources in industry.

I was involved in the following noise impact assessments during the Environmental Impact Assessment process (Noise and/or Vibration):

- Baseline environmental annual noise survey - Sishen Iron Ore Company (Pty)Ltd;
- Airlink BID for landing in Kruger National Park;
- Coal gasification plant in Theunissen;
- Langhoogte and Wolseley wind farms;
- Widening of N3 at Howick, KZN;
- Tulu Kapi Mine, Ethiopia;
- Boabab Iron Ore Mine, Mozambique;
- N11 Decommissioning Mokopane;

- Baseline noise survey for NuCoal Mines, Woestalleen, Vuna and Mooiplaats Collieries;
- Baseline noise monitoring Mooinooi mine;
- Leeuwpan coal mine;
- N17 Road at Trichardt for KV3 Engineers;
- N17 Road in Soweto;
- Proposed new by-pass road at Musina;
- George Western By-pass road between George Airport and Outeniqua Pass;
- Gautrain baseline monitoring;
- Upgrade of Delmas Road extensions in Moreletta Park, Pretoria;
- Proposed weigh bridge, N3, Pietermaritzburg:
- Tonkolili Manganese mine, Sierra Leone;
- Proposed wind turbines in the Western Cape – Caledon;
- Extension of works at the PPC factory in Piketberg;
- Exxaro Arnot Colliery – Mooifontein;
- Hydro power plant – 2 Sites in Durban;
- Coal export terminal in Beira, Mozambique;
- Site selection for new Power Station – Kangra Mine, Piet Retief;
- Gas exploration at Ellisras;
- Noise survey and assessment of future mine shafts at various mines;
- Mining exploration at Potgietersrus – Lonmin Akani;
- New coal mines in Witbank – Dorstfontein Expansion Project;
- New coal mines in Middelburg and Ermelo;
- New Vanadium Manganese mine in Potgietersrus;
- Xolobeni mining project in Transkei;
- Glynn mines in Sabie;
- Rezoning of properties for housing at Burgersfort, Shosanguve, Hammanskraal;
- Various noise impact assessment for clients in and around Centurion;
- Relocation of night races from Newmarket racecourse to Turfontein racecourse;
- Rezoning applications for private clients.

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on scientific and recommended survey and assessment techniques. This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Copyright

Executive summary

Introduction

dBAcoustics was appointed by EXM Advisory Services (Pty) Ltd to provide a professional opinion on the potential noise increase of the proposed DMS Upgrade Project for the processing of low grade Iron Ore material. It was not required to do a noise survey as dBAcoustics did a winter and summer noise survey during 2017. This noise data was used to assess if a noise intrusion will be created at the abutting noise sensitive areas.

The following noise sources prevail in the vicinity of and the boundaries of the study area:

- Mining activity noise such as open cast mining, processing plant activities, crushing of ore.
- Traffic noise – hauling of ore in the mine and ore of the mine by means of train and hauling vehicles;
- Motor vehicle noise from the employees along the abutting feeder roads;
- Insects and Birds;
- Wind noise.

Noise Impact Assessment

In terms of the Noise Regulations a noise disturbance is created when the prevailing ambient noise level is exceeded by 7.0dBA or more. The International Finance Corporation Health and Safety Guidelines allow for a benchmark noise level of exceedance of 3.0dBA. It will therefore be more environmentally sustainable for a new development that the latter benchmark be used as a completely mechanised development will be introduced into the study area. Noise is part of our daily exposure to different sources which is part of daily living and some of these physical attributes which may at times be intrusive forms part of the ambient levels that people get used to without noticing the higher levels.

Two aspects are important when considering potential impacts of a project:

- The increase in the noise levels, and;
- The overall noise levels which will be created by the DMS upgrade project.

Conclusion

There will be no noise increase in the prevailing ambient noise levels at the noise receptors outside the Sishen mine boundaries during both the operational phase as the projected noise levels will not exceed the prevailing ambient noise levels.

The proposed upgrade of the DMS Project will comply with the relevant Noise Control Regulations, 1994, SANS 10103 of 2008 and the IFC's Health and Safety Guidelines.

Barend van der Merwe – MSc UJ
Environmental noise and vibration specialist

Contents

Figures

Tables

1. Introduction

dBAcoustics was appointed by EXM Advisory Services (Pty) Ltd to provide a professional opinion on the potential noise increase of the proposed DMS Upgrade Project for the processing of low grade Iron Ore material. The Dense Media Separation (DMS) upgrade project will allow for the processing of A-grade and C-grade ore using Ultra High Dense Media Separation technology (UHMDS). An additional primary crusher (refurbished in-pit primary crusher) will be used for the crushing of C-Grade ore. Operations will continue for the remaining life of Sishen Mine. It was emphasised during the scoping process that there is a potential of increased noise levels within the plant area and at the abutting noise sensitive areas due to the mechanised method which will be used. This will be assessed and evaluated in terms of the prevailing ambient noise levels in the processing plant and at the abutting noise sensitive areas being Sesheng, Kathu, Dingleton, Kathu Agricultural Holdings and farmsteads to the west of Sishen mine. The location of the project within the boundaries of the Sishen mine boundaries is illustrated in Figure 1-1.

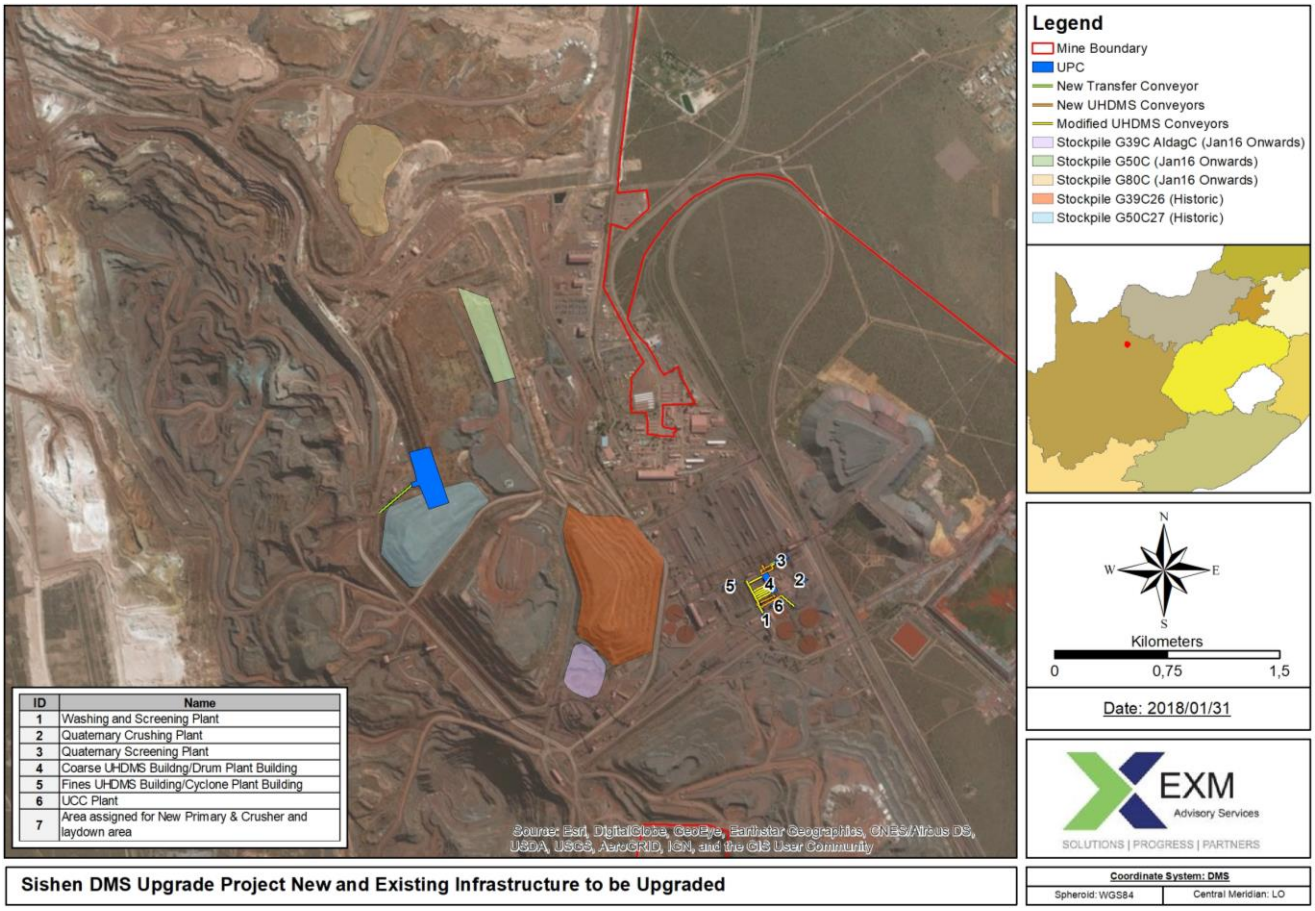


Figure 1-1: Location of the proposed DMS upgrade project

The classification of this area can be described as an industrial district according to Table 2 of SANS 10103 of 2008 with the recommended noise level along the boundaries of 70.0dBA during the day and the night.

2. Background to environmental noise

Sound is a wave motion, which occurs when a sound source sets the nearest particles of air in motion. The movement gradually spreads to air particles further away from the source. Sound propagates in air with a speed of approximately 340 m/s.

The sound pressure level in free field conditions is inversely proportional to the square of the distance from the sound source – inverse square law. Expressed logarithmically as decibels, this means the sound level decreases 6 dB with the doubling of distance. This applies to a point source only. If the sound is uniform and linear then the decrease is only 3 dB per doubling of distance. The decibel scale is logarithmic, therefore decibel levels cannot be added in the normal arithmetic way, for example, two sound sources of 50.0dB each do not produce 100.0dB but 53.0dB, nor does 50.0dB and 30.0dB equal 80.0dB, but remains 50.0dB. Air absorption is important over large distances at high frequencies and it depends on the humidity but is typically about 40.0dB/km @ 4000 Hz. Traffic noise frequencies are mainly mid/low and will be unaffected below 200m.

When measuring the intensity of a sound, an instrument, which duplicates the ear variable sensitivity to sound of different frequency, is usually used. This is achieved by building a filter into the instrument with a similar frequency response to that of the ear. This is called an A-weighting filter because it conforms to the internationally standardized A-weighting curves. Measurements of sound level made with this filter are called A-weighted sound level measurements, and the unit is dB.

Sound propagation is affected by wind gradient rather than the wind itself. The profile of the ground causes such a gradient. The sound may be propagated during upwind conditions upwards to create a sound shadow. A downwind refracts the sound towards the ground producing a slight increase in sound level over calm isothermal conditions. The velocity of sound is inversely proportional to the temperature therefore a temperature gradient produces a velocity gradient and a refraction of the sound. Temperature decreases with height and the sound is refracted upwards.

For a source and receiver close to the ground quite large attenuation can be obtained at certain frequencies over absorbing surfaces, noticeably grassland. This attenuation is caused by a change in phase when the reflected wave strikes the absorbing ground and the destructive interference of that

wave with the direct wave. The reduction in sound tends to be concentrated between 250 Hz and 600 Hz.

Noise screening can be effective when there is a barrier between the receiver and the source i.e. walls, earth mounds, cuttings and buildings. The performance of barriers is frequency dependent. To avoid sound transmission through a barrier the superficial mass should be greater than 10 Kg/m^2.

There is a complex relation between subjective loudness and the sound pressure level and again between annoyance due to noise and the sound pressure level. In general the ear is less sensitive at low frequencies and the ear will only detect a difference in the sound pressure level when the ambient noise level is exceeded by 3.0-5.0dBA.

There are certain effects produced by sound which, if it is not controlled by approved acoustic mitigatory measures, seem to be construed as undesirable by most people and they are:

- Long exposure to high levels of sound, which may damage the hearing or create a temporary threshold shift – in industry or at areas where music is played louder than 95.0 dBA. This will seldom happen in far-field conditions;
- Interference with speech where important information by the receiver cannot be analyzed due to loud noises;
- Excessive loudness;
- Annoyance.

A number of factors, for example clarity of speech, age of listener and the presence of noise induced threshold displacement, will influence the comprehensibility of speech communication.

The effect of noise (with the exception of long duration, high level noise) on humans is limited to disturbance and/or annoyance and the accompanying emotional reaction. This reaction is very difficult to predict and is influenced by the emotional state of the complainant, his attitude towards the noisemaker, the time of day or night and the day of the week.

Types of noise exposure:

- Continuous exposure to noise – The level is constant and does not vary with time e.g. traffic on freeway and an extractor fan;
- Intermittent exposure to noise – The noise level is not constant and occurs at times e.g. car alarms and sirens;

- Exposure to impact noise – A sharp burst of sound at intermittent intervals e.g. explosions and low frequency sound.

Noise affects humans differently and the new noise which will be coming from the mine establishment and the associated activities will depend upon the intensity of the sound, the length of time of exposure and how often over time the ear is exposed to it. Urban dwellers are besieged by noise, not only in the city streets but also in the busy workplaces and household noises.

The time-varying characteristics of environmental noise are described using statistical noise descriptors:

- Leq: The Leq is the constant sound level that would contain the same acoustic energy as the varying sound level, during the same period of time.

- L_{Max}: The instantaneous maximum noise level for a specified period of time.

- L_{Min}: The instantaneous minimum noise level for a specified period of time.

The following relationships occur for increases in A-weighted noise levels:

- The trained healthy human ear is able to discern changes in sound levels of 1.0dBA under controlled conditions in an acoustic laboratory;
- It is widely accepted that the average healthy ear can barely perceive noise level changes of 3.0dBA;
- A change in sound level of 5.0dBA is a readily perceptible increase in noise level;
- A 10.0dBA change in the sound level is perceived as twice as loud as the original source.

The World Bank in the Environmental Health and Safety Regulations has laid down the following noise level guidelines:

- Residential area – 55.0dBA for the daytime and 45.0dBA for the nighttime period;
- Industrial area – 70.0dBA for the day- and nighttime periods.

The difference between the actual noise and the ambient noise level and the time of the day and the duration of the activity, will determine how people will respond to sound and what the noise impact will be. In order to evaluate such, there must be uniform guidelines to evaluate each scenario. SANS

10103 of 2008 has laid down sound pressure levels for specific districts and has provided the following continuous noise levels per district as given in Table 2.1.

Table 2-1: Recommended noise levels for different districts.

Type of district	Equivalent continuous rating level ($L_{Req.T}$) for ambient noise - dBA					
	Outdoors			Indoors, with open windows		
	Day-night L_{Rdn}	Daytime L_{Reqd}	Night-time L_{Reqn}	Day-night $L_{R.dn}$	Daytime $L_{Req.d}$	Night-time $L_{Req.n}$
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts with some workshops, with business premises and with main roads	60	60	50	50	50	40
e) Central business district	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

For industrial districts, the $L_{R.dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24h day/night cycle, $L_{Req.d} = L_{Req.n} = 70$dBA can be considered as typical and normal.

The response to noise can be classified as follows:

- An increase of 1.0dBA to 3.0dBA above ambient noise level will cause no response from the affected community. For a person with normal hearing an increase of 0dBA to 3.0dBA will not be noticeable
- An increase between 1.0dBA – 10.0dBA will elicit little to sporadic response. When the difference is more than 5.0dBA above the ambient noise level a person with normal hearing will start to hear the difference.
- An increase between 5.0dBA and 15.0dBA will elicit medium response from the affected community.
- An increase between 10.0dBA and 20.0dBA will elicit strong community reaction.

Because there is no clear-cut transition from one community response to another as well as several variables, categories of responses can overlap. This should be taken into consideration during the evaluation of a potential noise problem. There is therefore a mixture of activities and higher noise levels as per the above recommended continuous rating levels within i.e. residential, industrial and feeder roads in close proximity of each other. The ambient noise level will therefore differ throughout the study area, depending on the region and the measuring position in relation to areas with existing

mining activities. People exposed to an increase in the prevailing ambient noise level will react differently to the noise levels and the response is given in Table 2.2.

Table 2-2: Estimated community/group response when the ambient noise level is exceeded

	Estimated community/group response	
Excess dB	**Category**	**Description**
0	None	No observed reaction
0-10	Little	Sporadic complaints
5-15	Medium	Widespread complaints
10-20	Strong	Threats of community/group action
>15	Very strong	Vigorous community/group action

The IFC Environmental, Health and Safety (EHS) Guidelines (IFC 2007) (Ref. 2) are based on the World Health Organisation (WHO) guideline values (WHO 1999). The guideline values are specified as either a fixed noise limit or an increase of 3 dB over ambient noise levels (**Error! Reference source not found.**).

The guidelines advise that, where noise levels attributable to an installation or operation exceed the guideline values at the façade of the nearest noise receptor, appropriate noise mitigation measures should be adopted.

Table 2-3: Environmental Health and Safety Guidelines for Noise

Receptor	Either		Or
	Period		Where baseline exceeds IFC guideline
	Daytime (07h00 - 22h00)	Night time (22h00 – 7h00)	
Residential, institutional and educational	55.0dBA	45.0dBA	3dB increase over baseline
Industrial and commercial	70.0dBA	70.0dBA	

3. Methodology

The potential noise impact assessment was done by using the environmental noise data which was collected by dBAcoustics during a noise survey done during the winter (14 & 15 August 2017) and summer (21, 22 & 23 November 2017). The distances between the noise sources of the proposed DMS plant (UPC) and UHDMS plant to the noise sensitive areas as illustrated in Table 2.1 was determined by using Google imagery. The projected noise levels from the proposed DMS project at the measuring locations were calculated by using the ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 2. General method of calculation.

The distance (m) between the measuring locations (noise sensitive areas) and the UPC & Overland conveyor and UHDMS are illustrated in Table 3.1.

Table 3-1: Distances between the proposed project areas and the measuring points

Location	Distance between the measuring point and the proposed project sections in meters	
	UPC & Overland conveyor	UHDMS
Sheseng	4 435	5 627
Western side of Kathu	5 754	5 346
Eastern side of Sishen mine	4 031	2 373
Kathu Agricultural Holdings	9 131	7 030
Dingleton	4 050	5 210
Farms to the west of Sishen mine	8 934	11 071

4. Prevailing ambient noise levels

A noise survey was carried out by dBAcoustics during the winter (14 & 15 August 2017) and summer (22 & 23 November 2017) and the prevailing noise levels are given in Table 4.1 and Table 4.2.

Table 4-1: Arithmetic prevailing noise levels during the winter

Location	Prevailing ambient noise levels in dBA	
	Prevailing ambient noise level - day	Prevailing ambient noise level - night
Sheseng	41.9	32.6
Western side of Kathu	47.1	37.7
Eastern side of Sishen mine	39.5	34.4
Kathu Agricultural Holdings	38.2	28.3
Dingleton	44.1	43.9
Farms to the west of Sishen mine	31.7	30.3

Table 4-2: Arithmetic prevailing noise levels during the summer

Location	Prevailing ambient noise levels in dBA	
	Prevailing ambient noise level - day	Prevailing ambient noise level - night
Sheseng	44.0	37.8
Western side of Kathu	47.3	39.6
Eastern side of Sishen mine	40.4	37.8
Kathu Agricultural Holdings	37.0	35.1
Dingleton	47.3	47.3
Farms to the west of Sishen mine	36.9	31.1

5. Projected noise levels and intrusion levels

The assessment of environmental noise impacts will vary because of the different prevailing ambient noise levels in different districts according to Table 2 of SANS 10103 of 2008. The recommended noise levels of these districts are referred to (Table 2-1). In order to simplify the assessment of the magnitude of noise impacts in terms of noise increases, it is recommended that the increase in the in the prevailing ambient noise level is quantified as follows:

The following equation was used to calculate the noise level at the noise sensitive areas during the :

$$Lp = Lw - 20\log R - \alpha$$

Where, Lp is the sound level at a distance from the source in dBA;

Lw is the sound level at the source in dBA;

α is the noise reduction due to the distance from the source (5.0dBA);

R is the distance from the source.

The above formula and the Interactive noise calculator (ISO 9613) were used to determine the noise intrusion levels during the operational phase of the project. The noise levels at the noise sensitive areas will be added in a logarithmic manner to determine the overall sound exposure at the receptor.

The increase in the prevailing ambient noise level is calculated in the following manner:

LReq,T = LReq,T (post) - LReq,T (pre)

where,

LReq,T (post) – noise level after completion of the project – projected or calculated noise levels;

LReq,T (pre) – noise level before the proposed project – ambient noise level.

The criteria for assessing the magnitude of a noise impact are illustrated in Table 5.1 (SANS 10103 of 2008).

Table 5.1: Noise intrusion level criteria

Increase Δ-dBA	**Assessment of impact magnitude**	**Colour code**
$0 < \Delta \leq 1$	Not audible	
$1 < \Delta \leq 3$	Very Low	
$3 < \Delta \leq 5$	Low	
$5 < \Delta \leq 10$	Medium	
$10 < \Delta \leq 15$	High	
$15 < \Delta$	Very High	

The projected noise levels at the different measuring areas are illustrated in Table 5.2 (winter period) and Table 5.3 (summer period). There will be no noise intrusion as the prevailing ambient noise levels will not be increased due to the three proposed point noise sources (UPC & overland conveyor and UHMDS). The noise source values were calculated at each of the noise receptors added logarithmic to get the cumulative noise level. The cumulative noise level was added to the prevailing ambient noise level as this will be the new prevailing noise level. This value is subtracted from the cumulative noise value to determine the intrusion level. There was a difference in the prevailing noise levels for the summer and the winter periods for the day and the night. There will be no noise intrusion during the winter or summer periods and the proposed upgrade will comply with the South African Standards and the IFC's Health and Safety Guidelines.

Table 5.2: Noise intrusion levels during the winter period

Residential property	All the values are in dBA									
	UPC	UHDMS	Conveyor	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Ambient daytime	Ambient night time	Intrusion noise level - daytime	Intrusion noise level - night time
Sheseng	9.1	5.5	2.6	11.3	41.9	32.6	41.9	32.6	0.0	0.0
Western side of Kathu	6.8	5.9	0.3	9.9	47.1	37.7	47.1	37.7	0.0	0.0
Eastern side of Sishen mine	9.9	13.0	3.4	15.0	39.5	34.4	39.5	34.4	0.0	0.0
Kathu Agricultural Holdings	2.8	3.6	-3.7*	6.6	38.2	28.3	38.2	28.3	0.0	0.0
Dingleton	9.9	6.2	3.4	12.0	44.1	43.9	44.1	43.9	0.0	0.0
Farms to the west of Sishen mine	3.0	-0.4*	-3.5*	5.2	31.7	30.3	31.7	30.3	0.0	0.0

*The negative value is an indication that the noise from the conveyor will not be audible at all. This value was replaced with a 0-value in calculating the intrusion levels.

Table 5.3: Noise intrusion levels during the summer period

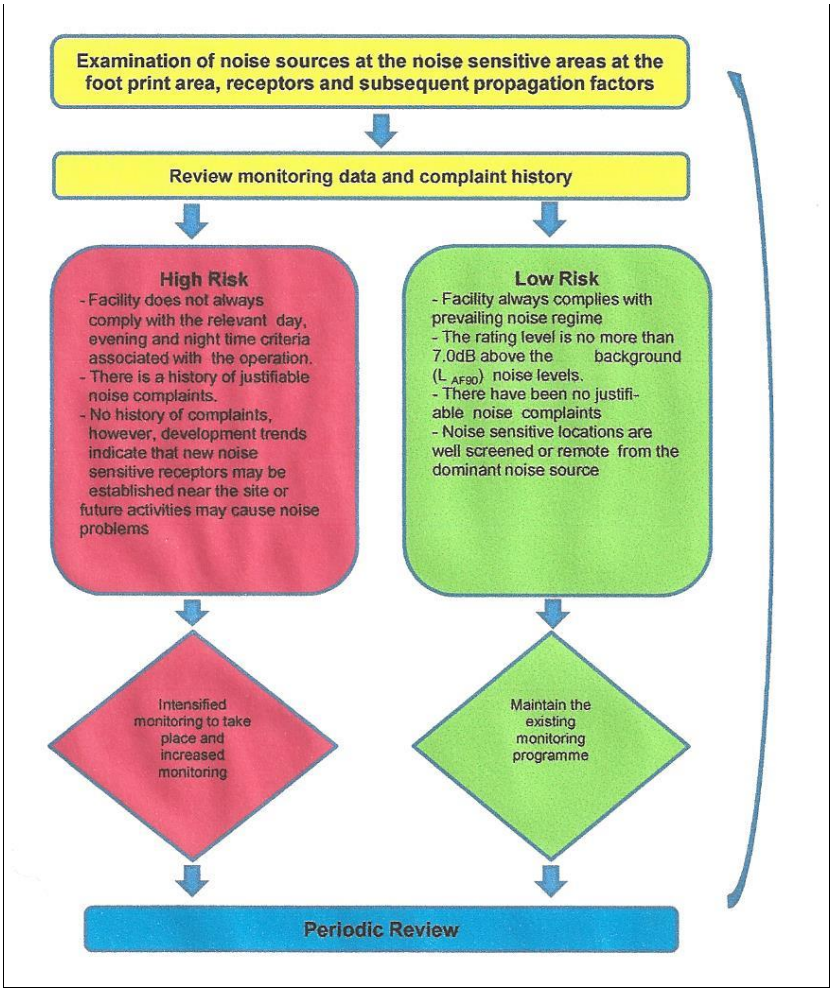
Residential property	All the values are in dBA									
	UPC	UHDMS	Overland conveyor	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level - Night time	Ambient daytime	Ambient night time	Intrusion noise level - daytime	Intrusion noise level - night time
Sheseng	9.1	5.5	2.6	11.3	44.0	37.8	44.0	37.8	0.0	0.0
Western side of Kathu	6.8	5.9	0.3	9.9	47.3	39.6	47.3	39.6	0.0	0.0
Eastern side of Sishen mine	9.9	13.0	3.4	15.0	40.4	37.8	40.4	37.8	0.0	0.0
Kathu Agricultural Holdings	2.8	3.6	-3.7*	6.6	37.0	35.1	37.0	35.1	0.0	0.0
Dingleton	9.9	6.2	3.4	12.0	47.3	47.3	47.3	47.3	0.0	0.0
Farms to the west of Sishen mine	3.0	-0.4*	-3.5*	5.2	36.9	31.1	36.9	31.1	0.0	0.0

*The negative value is an indication that the noise from the conveyor will not be audible at all. This value was replaced with a 0-value in calculating the intrusion levels.

The noise intrusion levels during the operational phases will be insignificant as the proposed DMS upgrade project will take place in a disturbed area where there are industrial activities taking place which increase the prevailing ambient noise levels accordingly.

The following noise management plan as illustrated in Figure 5.1 must be used to identify any new noise sources which may have an impact on the abutting noise sensitive areas.

Figure 5-1: Noise management plan



6. Conclusion

The proposed DMS Upgrade project will be situated in an area where there are existing mining activities such as open cast mining, blasting, processing plant activities and train movement, hauling along mine roads and feeder roads. The noise impact assessment revealed that the noise increase will be insignificant at the abutting noise receptors to the Sishen mine as the prevailing ambient noise will not be exceeded.

The activities, during the operational phases of proposed DMS Upgrade project, will comply with the relevant Noise Control Regulations, 1994, IFC Health and safety Guideline and SANS 10103 of 2008 provided that the prevailing ambient noise level will not be exceeded and that the noise management plan (Figure 5.1) be adhered to at all times.

Barend van der Merwe – MSc UJ
Environmental noise and vibration specialist

7. List of Definitions and Abbreviations

7.1 Definitions

Ambient noise
The totally encompassing sound in a given situation at a given time and usually composed of sound from many sources, both near and far

A-weighted sound pressure level (sound level) (L_{pA}), in decibels
The A-weighted sound pressure level is given by the equation:

$L_{pA} = 10 \log (p_A/p_o)^2$

Where

p_A is the root-mean-square sound pressure, using the frequency weighting network A in pascals; and

p_o is the reference sound pressure (p_o = 20 μPa).

NOTE The internationally accepted symbol for sound level is dBA.

Distant source
A sound source that is situated more than 500 m from the point of observation

Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$), in decibels
The value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T, has the same mean-square sound pressure as a sound under consideration whose level varies with time. It is given by the equation

$$L_{Aeq,T} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2(t)}{p_o^2} dt \right]$$

Where
$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level, in decibels, determined over a time interval T that starts at t_1 and ends at t_2;

p_o is the reference sound pressure (p_o = 20 μPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal, in pascals.

Impulsive sound
Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise

Initial noise
The component of the ambient noise present in an initial situation before any change to the existing situation occurs

Intelligible speech
Speech that can be understood without undue effort

Low frequency noise

Sound, which predominantly contains frequencies below 100 Hz

Nearby source
A sound source that is situated at a distance of 500 m or less from the point of observation

Residual noise
The ambient noise that remains at a given position in a given situation when one or more specific noises are suppressed

Specific noise
A component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source
NOTE Complaints about noise usually arise as a result of one or more specific noises.

Ambient sound level
Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Disturbing noise
Means a noise that causes the ambient noise level to rise above the designated zone level by 7.0dBA or if no zone level has been designated, the typical rating levels for ambient noise in districts, indicated in table 2 of SANS 10103.

Noise nuisance
Means any sound which disturbs or impairs the convenience or peace of any person

7.2 Abbreviations

dBA – A-weighted sound pressure level;

IFC – International Finance Corporation;

m/s – meters per second;

NSA – Noise sensitive areas;

L_{Basic} – Basic noise level in dBA;

SANS – South African National Standards;

15. References:

Environmental, Health and Safety Guidelines for Community Noise, World Health Organisation, Geneva, 1999;

Environmental Protection Agency (EPA). Office of Environmental Enforcement (OEE) Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4). April, 2012. http://*www.epa.ie* › About Us › Organisational Structure. *Accessed 12 July 2012.*

Google Earth, 2010, http//www.google.com/earth/download-earth.html.
Accessed 4 February 2018**;**

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 1. Calculation of the absorption of sound by the atmosphere;

International Organization for Standardization – ISO (1993). ISO 9613-1:1993. Attenuation of sound during propagation outdoors – Part 2. General method of calculation;

Noise Control Regulations - Noise Regulations of 1992. GN154 as promulgated in Government Gazette No. 13717 dated 10 January 1992;

RSA, 1996. Statute of the Republic of South Africa – Constitutional Law, No 108 of 1996;

SANS 10357 of 2004 – The calculation of sound propagation by the concave method (SANS, 2004);

SANS 10210 of 2004 – Calculating and predicting road traffic noise (SANS, 2004);

SANS 10328 of 2008 – Methods for environmental noise impact assessments (SANS, 2008);

SANS 10103 of 2008 – The measurement and rating of environmental noise with respect to annoyance and to speech communication (SANS, 2008);

World Bank, 1995, Guidelines for community noise. *International Finance Corporation General Concerns*. http://www.who.euromat.org. Accessed 20 July 2012.