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Retrieval and scientific interpretation of ecotoxicological information

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Project conducted on behalf of Environmental Management Assistance (Pty) Ltd

Rapid Appraisal Health Impact Assessment for a Proposed Open Pit Mining Operation:

Scoping Report

Report No 065-2022 Rev 2.0

Compiled by

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8 August 2022

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8 August 2022

Expertise and Declaration of Independence

This report was prepared by INFOTOX (Pty) Ltd ("INFOTOX"). Established in 1991, INFOTOX is a professional scientific company, highly focused in the discipline of Health Sciences. Both occupational and environmental human health risks, as well as risks to ecological receptors, are addressed.

Dr Willie van Niekerk, Managing Director of INFOTOX, has BSc, Hons BSc and MSc degrees from the University of Potchefstroom and a PhD from the University of South Africa. He is a Qualified Environmental Professional (Environmental Toxicologist QEP), certified by the Institute of Professional Environmental Practice (IPEP) in the USA (No 07960160), and a registered Professional Natural Scientist registered in South Africa (Pr Sci Nat, Environmental Science, No 400284/04). Dr Van Niekerk has specialised in chemical toxicology and human health risk assessments, but he has experience in many other areas in the disciplines of analytical and environmental sciences.

Dr Marlene Fourie has BSc and Hons BSc degrees from the University of Stellenbosch and MSc and PhD degrees from the University of Pretoria. Her field of specialisation is reproductive biology/toxicology. Dr Fourie also has an MSc-degree in epidemiology from the University of Pretoria. Following positions as Medical Natural Scientist at the Andrology Unit, Department of Urology, University of Pretoria and the Pretoria Academic Hospital from 1987 to 2001, she joined INFOTOX as a Medical Biological Scientist. Dr Fourie has conducted many health risk assessments and projects relating to the health status of communities. She is registered as a Professional Natural Scientist (Pr Sci Nat, Toxicological Science, No 400190/14).

This specialist report was compiled for Environmental Management Assistance (Pty) Ltd. We do hereby declare that we are financially and otherwise independent of Environmental Management Assistance (Pty) Ltd.

Signed on behalf of INFOTOX (Pty) Ltd, duly authorised in the capacity of Managing Director:

Willem Christiaan Abraham van Niekerk

8 August 2022

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1 Introduction

Environmental Management Assistance (Pty) Ltd ("EMAssistance") appointed INFOTOX (Pty) Ltd ("INFOTOX") to conduct a rapid appraisal health impact assessment (RAHIA) required for a mining right application by BCR Coal (Pty) Ltd ("BCR Coal").

BCR Coal is proposing an open pit mining operation, hereafter referred to as the BCR Coal Vlakfontein Mine, situated on Portion (Ptn) 2, Ptn 11 and Ptn 21 of farm Vlakfontein 108 IT, Ptn 1, 7, 14 and 12 of farm Welgelegen 107 IT, and Ptn 1 of farm Mooifontein 109 IT. The proposed operation is in the Msukaligwa Local Municipality (LM), situated in the Gert Sibande District Municipality (DM), of Mpumalanga. The proposed mining area is in parts of Municipal Wards 14, 18 and 19. The general location map is presented in Figure 1.1.

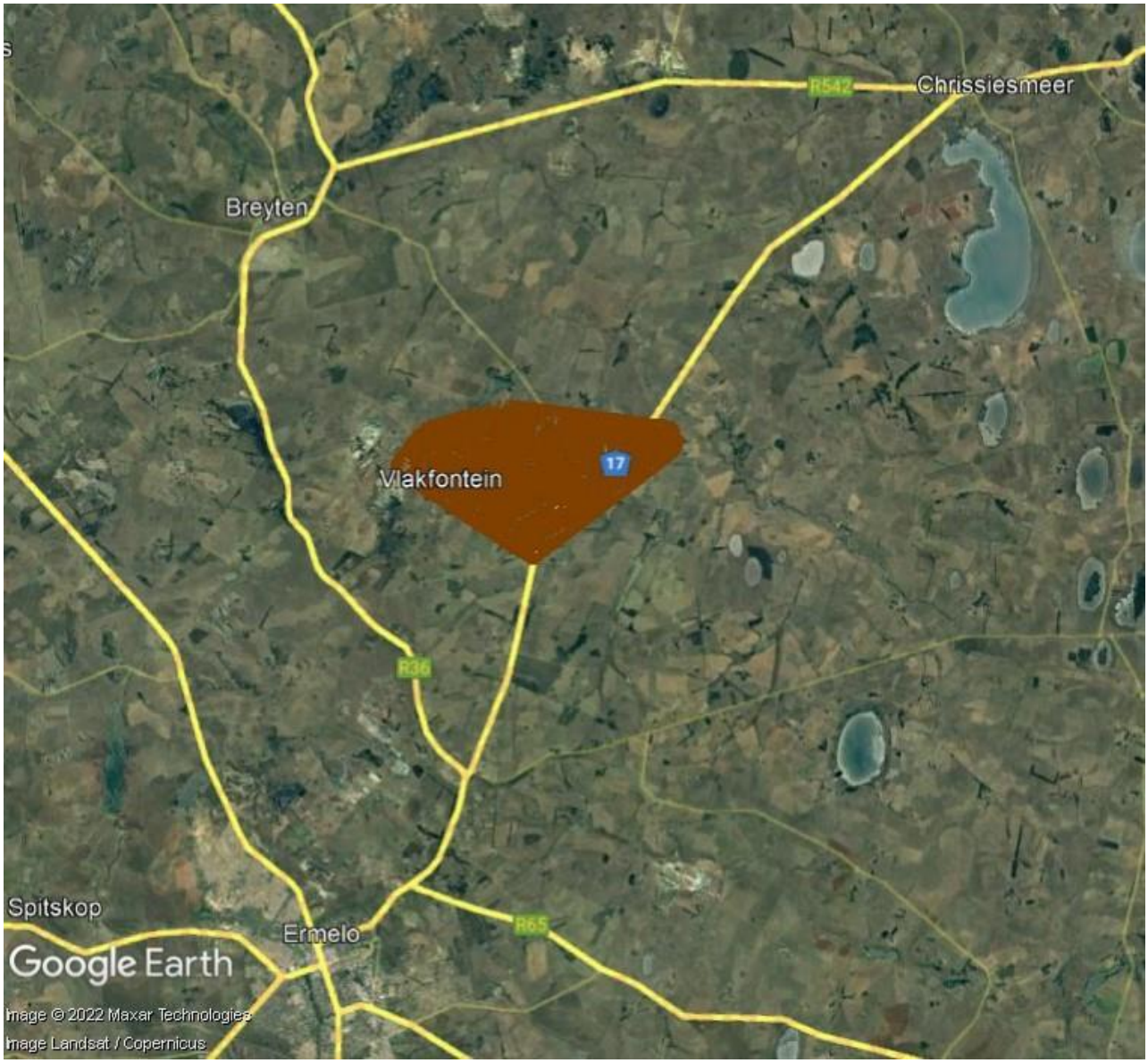

Figure 1.1: Location map of the proposed BCR Coal mining site.

2 Site sensitivity verification

Reference is made to site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed, as published in Government Notice No 320, Government Gazette 43110, 20 March 2020[1].

The site sensitivity verification requirements do not apply to a RAHIA, as the assessment is conducted on the basis of the site footprint, dispersion of hazardous substances from the operations, and potential health impacts on neighbouring communities. Vulnerability of potentially affected members of the community is taken into account in the RAHIA.

A summary of the desktop verification output is presented in the table below.

Screening tool sensitivity	Verified sensitivity	Outcome statement/plan of study	Relevant section motivating verification
Not applicable	Not applicable	Apply information from air quality impact assessment and assessment focus areas to conduct a RAHIA in the EIA	Not applicable

3 Scoping report

This document presents the scoping of the RAHIA, according to the Good Practice guidance of the International Finance Corporation (IFC), a member of the World Bank Group (IFC 2009). INFOTOX is guided, amongst other IFC guidelines, by the *Introduction to Health Impact Assessment*.

The IFC differentiates between two types of health impact assessments (HIAs), namely a comprehensive and a rapid appraisal HIA. The comprehensive HIA is recommended when the project is likely to attract or involve a significant influx of people, for example a large construction work force. Other factors in favour of a comprehensive HIA include resettlement or relocation of local inhabitants or communities, significant construction activity, or the assessment of a large project in a rural setting.

The proposed BCR Coal open pit mining operation does not involve relocation of people and does not have a strong emphasis on any of the factors requiring a comprehensive health impact assessment. Therefore, a rapid appraisal HIA is performed.

4 Terms of reference for the RAHIA

4.1 Elements of the assessment

According to the IFC, the RAHIA is a limited in-country assessment that does not require new data collection within the communities of concern. Data necessary to assess potential health impacts of proposed developments on potentially affected communities are extracted from existing data sources. It is evident that this requires a review determining the availability of existing data sources and a review of such sources to identify and select data relevant to the communities of concern. The IFC suggests that a limited desktop review will suffice.

[1] www.gpwonline.co.za.

With regard to the BCR Coal open pit mining operation, it is expected that potential impacts on air quality, and potential resultant impacts on the health of receptor communities, will be of primary interest. The main focus of the RAHIA is the impact of substances released or dispersed into air on the health of surrounding communities. Due to this focus, air dispersion modelling of the potential impact on air quality will be necessary. This should involve the potentially impacted geographical area, done according to the terms of reference for the Air Quality Impact Assessment (AQIA), by air quality specialists appointed by EMAssistance.

4.2 Assessment focus areas

Integral to the RAHIA is the environmental human health risk assessment (HHRA), which will be conducted by INFOTOX. In terms of the RAHIA, the geographical study area considered as impacted include those areas and communities where the proposed developments may have an impact on the environmental quality. The assessment of the impacts via air is performed using the results of the HHRA, which is based on concentrations of hazardous substances in air, whether measured or modelled. EMAssistance has appointed air dispersion modelling specialists to investigate the potential impacts of the proposed mining operation and publish an Atmospheric Impact Report (AIR).

INFOTOX requires PM2.5 dispersion modelling data provided in the AIR, which will serve as source of input data for the health risk assessment. The AIR should identify the locations of sensitive receptors and ambient air concentrations of PM2.5 across the study area, averaged over specified exposure periods. INFOTOX has to liaise with the air dispersion modelling specialists prior to the initiation of air quality modelling, because INFOTOX requires the information in a specific format. Air quality specialists normally present data in the format of exceedances of air quality standards, whereas INFOTOX requires exposure concentrations of pollutants.

Simplistic comparisons between exposure concentrations and ambient air quality guidelines or standards are inadequate to quantify health outcomes, mainly because ambient air quality guidelines are used for management of air quality and are not intended for risk quantification. Air quality guidelines or standards also do not relate exposures to specific health endpoints, which limits the effectiveness of risk communication.

Occupational health risk assessment is not included in this assessment.

4.3 The human health risk assessment paradigm

The original paradigm for regulatory HHRA in the USA was developed by the USA National Research Council (NRC 1983). This model has been adopted and refined by the US Environmental Protection Agency (USEPA) and other international agencies as published under the International Programme on Chemical Safety (IPCS 1999; IPCS 2010) and is widely used for quantitative human health risk assessments. The elements of the HHRA approach are described below.

Hazard assessment

Hazard assessment is the identification of chemical contaminants suspected to pose hazards and a description of the types of toxicity that they may evoke. The air contaminant of concern in this study is PM2.5.

Exposure-response assessment

The exposure-response assessment addresses the relationship between levels and periods of

exposure and the manifestation of adverse health effects in humans, and/or how humans can be expected to respond to different concentrations of contaminants in air.

Mortality or hospitalisation rates for respiratory or cardiovascular causes are the measures of associated illness that are mostly applied in epidemiological studies of community health risks associated with exposure to PM2.5. The international scientific literature is not static and major regulatory agencies such as the US Environmental Protection Agency (USEPA) and the UK Committee on the Medical Effects of Air Pollutants (COMEAP) regularly review their risk models.

This requires timely reviews of the literature by the health risk assessor and the status of information is checked prior to conducting health risk assessments.

The community health risk assessment involves the calculation of the potential increase in or contribution to the risk of hospital admissions or mortality due to specific causes, associated with air concentrations of specific pollutants. These calculations are based on results of epidemiological studies reported in the international scientific literature in which statistical methods were used to compare hospitalisation or mortality rates with air quality. Current statistical methods use the concept of relative risk to derive the potential increase in or contribution to effects. The potential increase or contribution associated with the pollutant contributed by a specific source, in this case, emissions from the proposed mining operation, is calculated using the approach of the World Health Organization (WHO), which will be discussed in the human health risk assessment report.

In the assessment of health risks, it is of critical importance to focus on health outcomes for which adequate scientific evidence has been documented. The issue of causality is fundamental in this regard, because assessments have to be based on health impacts linked to exposure with a significant degree of confidence.

Health effects in the “likely to be causal”, “suggestive of a causal relationship” and “inadequate to infer a causal relationship” categories are weakly characterised and can mostly not be used in health risk assessments.

The percentage change in personal risk of a specific health effect associated with a specific criteria pollutant emitted from the mining operation is calculated by INFOTOX. Please note that INFOTOX will thus not calculate the number of individuals experiencing a specific health effect, because the affected population numbers are too low. Basing interpretations on personal risk is adequate and acceptable in the assessment of health risks in small communities.

Exposure assessment

In the case of emissions to air, exposure assessment includes estimates of concentrations and duration of exposure of hazardous substances in air and identification of potentially exposed individuals or communities. Exposure assessment in this study is based on the air pathway of exposure and the route of exposure is by inhalation.

Exposure scenarios are also defined in terms of the length of periods of exposure. In the case of PM2.5, short-term (acute) exposure is based on the 99th and 75th percentiles of the modelled average 24-hour air concentrations. The 99th percentiles are used to calculate the reasonable upper risk limits and the 75th percentiles, if made available by the air dispersion modeller, are used to calculate a conservative central risk estimate. Chronic exposure is based on the modelled annual average concentrations of PM2.5.

Risk characterisation

Risk characterisation involves the quantification of health risks and the integration of the HHRA components described above, with the purpose of determining whether specific exposures to an individual or a community might lead to adverse health effects.

Uncertainty review

This review identifies the nature and, when possible, the magnitude of the uncertainty and variability inherent in the characterisation of risks. The results of any risk assessment are inherently affected by, firstly, scientific uncertainty associated with limitations in available data and assumptions that are made in the absence of such data. Secondly, the results are subject to variability in exposure and toxicological response expected, given the diversity within the human population. These uncertainties, assumptions and limitations that form part of all risk characterisation must be discussed in the uncertainty review of the risk assessment report. The uncertainty review also demonstrates the level of confidence in the outcome of the risk assessment and indicates whether additional data might be required, or whether elements of the precautionary principle should be applied.

4.4 Input from the Air Quality Impact Assessment

The results of air dispersion modelling are estimates of the resultant air concentrations of dispersed contaminants in the vicinity of impacted communities. Estimates of incremental air concentrations are the input needed to estimate potential human health risks in terms of selected health effects of interest according to the airborne contaminants of interest. The results of the HHRA, together with the baseline health status of the impacted communities, are used to conduct an HIA.

INFOTOX data requirements from the AQIA are as follows:

Particular matter as PM2.5

- 75th percentile of daily (24-hours average) concentrations
- 99th percentile of daily (24-hours average) concentrations
- Annual average concentration

The air dispersion modelling domain is determined by the expert air dispersion modeller and the HHRA is focused on the receptor communities within the air dispersion modelling domain.

4.5 Desktop review of available health literature

The baseline health status of the exposed communities is an important determining factor considered in the assessment of health impacts. The baseline health status assessment is compiled by INFOTOX, based on a desktop study of available health data for the receptor area. The intention of the desktop review of available published health literature is to provide baseline health data on the underlying burden of disease for the RAHIA and to identify specific vulnerabilities that might influence health impacts associated with the proposed operations. The following aspects are covered:

- Evaluate the underlying burden of disease, based on information gathered by INFOTOX from available open sources. Examples of open sources are World Health Organization health data and data potentially available from South African National, Provincial and Local Government Departments.

- Various burden-of-disease indicators are examined, such as:

- Vector-related diseases
- Soil- and waterborne diseases, if applicable
- Sexually transmitted diseases
- Nutrition-related diseases
- Communicable and non-communicable diseases
- Health impact assessments related to the project and the area, if available

Identification and consideration of sensitive groups are important activities in the RAHIA. Examples of sensitive groups are elderly individuals, infants and young children. It is also important to identify localities where sensitive groups might congregate, such as schools, old age homes, sports fields and community halls. Community-specific information, such as the adequacy of health care facilities, may also be considered in the RAHIA. Sensitive groups and their likely localities are usually identified in the Social Impact Assessment, from which INFOTOX will obtain the necessary data.

4.6 Rapid appraisal health impact assessment output

The output of the RAHIA is a contextualised rapid assessment of the potential health impact of the proposed open pit mining operation. The significance of various identifiable impacts is assessed as suggested by the IFC (2009) based on factors such as:

- The likely perception of risks by potentially affected communities
- The nature of the impacts, whether direct, indirect or cumulative
- The timing and duration of impacts
- The extent, magnitude and frequency of impacts

The IFC (2009) also suggests that risks should be ranked in terms of severity and the probability of occurrence.

Criteria for the evaluation of impacts and impact significance ratings to be used in the impact assessment should be provided to INFOTOX. This will ensure consistent rating and assessment with impact assessments that will be compiled by other specialists. The construction and operation phases will be rated separately.

5 Reasoned opinion regarding the acceptability of the proposed activity

It is not possible to express an opinion about the acceptability of the proposed project in the baseline assessment, as INFOTOX requires details of the AQIA, as outlined in Section 4.4 above. Furthermore, INFOTOX has to review available health information of potentially affected members of the community, as described in Section 4.5 above. These data will feed into the RAHIA. It is not possible to indicate potential fatal flaws

6 References

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