ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Kansanshi

First Quantum , Zambia

ID: 62

German Environment Agency

Umwelt Bundesamt

Note

The qualitative assessment of Environmental Hazard Potentials (EHPs) in this factsheet was conducted according to the method developed in the precursor project ÖkoRess I "Discussion of the environmental limits of primary raw material extraction and development of a method for assessing the environmental availability of raw materials to further develop the criticality concept"[1] (Dehoust et al. 2017a). The measurement instructions applied here are described in Dehoust et al. 2017b. The method is tested and further developed within this project (ÖkoRess III).

The information in this factsheet refers exclusively to publicly available, designated sources that have been classified as serious by the authors. It is specifically pointed out that no statement is made about the implementation and quality of agreements or standards that are applied. The implementation of agreements through memberships, certifications, etc. is the responsibility of the companies.

The surface extension of each mine area has been estimated based on publically accessible satellite images as official land-use plans from the public authorities or mine operators are not consistently available. It therefore only corresponds to the apparent area where mining, processing facilities, heaps, etc. and related infrastructure are clearly identifiable.

The fact sheets make no claim to completeness of all relevant voluntary standards. Mentioning a membership in one of the listed voluntary standards does not imply an assessment of the suitability of the standard in itself, nor does it make any statement about the member's success in implementation.

[1]TEXTE 87/2017 https://www.umweltbundesamt.de/publikationen/discussion-of-the-environmental-limits-of-primary

Kansanshi

Copper

General information

Indicator or criteria	Description and values
Name of mine	Kansanshi
Description of mining area	Kansanshi is a copper and gold mine with two open-pits (Main and Northwest). The deposit hosts both sulphide and oxide mineralisation. The climate in that region of Zambia is characterized by a warm two-season-climate (dry and wet) with precipitation from November to March. Semi-deciduous broadleaf forests are typical for the vegetation in that region (Gray et al. 2015 p. 33). The mine lies within the Domes Region and is hosted by the Katangan Supergroup sediments within the Central African Copper belt. Due to its NW-SE orientated antiformal structure, the Kansanshi sequence is also known as the Kansanshi Antiform. At Kansanshi, mainly oxide, secondary sulphide and primary sulphide mineralisation with distinct mixed zones are found. While Sulphide mineralisation consists mainly of chalcopyrite and bornite, occurring oxide minerals are malachite and chrysocolla (Gray et al. 2015 pp. 41–45; Mining Technology n.d.).
Surface extension	73.34km^2 73.34 km^2 (Image date: 11.9.2019; Viewing height: 11.36 km) (Google Earth)
In operation since	2004 2004 (Gray et al. 2015 p. 38)
Operator	Kansanshi Mining PLC
Owner	First Quantum
Closest town	15 km north of Solwezi (Gray et al. 2015 p. 11)
Province	North-Western Province (Google Maps 2019)
Country	Zambia
Longitude	26.41666°

Latitude	-12.08305°
Altitude	1427 m a.s.l. 1427 m a.s.l.
Main product and by-products	Main product: copper, by-product: gold (First Quantum n.d.)
On-site processing stages	Crushing, milling, flotation, solvent-extraction and electrowinning (SX-EW), smelting (Gray et al. 2015 pp. 11–12)
Annual production	252 kt of copper in concentrates, 130,019 ounces of gold (2018) (First Quantum 2019a)
Proven Reserves	65.4 Mt ore; Grade copper 0.52 %; Grade gold 0.10 g/t (First Quantum 2019b)
Probable Reserves	475.8 Mt ore; Grade copper 0.66 %; Grade gold 0.12 g/t

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	According to the Technical Report, the Kansanshi ore body/waste rock has significant neutralising capacity and as a result, all tailings material has historically been alkaline in nature. The report concludes that: due to "the dominance of neutralising material, long term acid generation […] is considered to be unlikely" (Gray et al. 2015).	Given the potential of neutralising material, long term acid generation at the mine is considered to be unlikely (Gray et al. 2015). However, sulphide ore is mined and therefore preconditions for AMD are given. In light of the reported technical review for the mine and the presence of sulphide minerals, a Medium EHP rating for AMD is awarded.	Medium	A = high, can be derived directly from available data
Paragenesis with heavy metals	Copper is considered a heavy metal and there is also indication of nickel in the ore body (Gray et al. 2015).	Given that copper and nickel are considered heavy metals, the mine is classified with a High EHP, following	High	A = high, can be derived directly from available data

		the measuring instructions (Dehoust et al. 2017b)		
Paragenesis with radioactive components	There are traces of uraninite as the depth of the ore body increases, with no further information on the levels of uraninite noted (Gray et al. 2015).	Since traces of radioactive minerals without further information on the level of uranite in the deeper ore body, a medium EHP rating is assigned.	Medium	A = high, can be derived directly from available data
Deposit size	The mine has been in production since 2005. Assuming current production to be average a total of ca. 3.5 Mt of copper have been produced (First Quantum 2019a). Adding the reserves the deposit has a size of ca. 7 Mt of copper (First Quantum 2019b).	The deposit size is evaluated as large according to the measurement instructions, resulting in a high EHP as larger deposits potentially have a higher expected total impact on the natural environment (Dehoust et al. 2017b).	High	A = high, can be derived directly from available data
Ore grade	Copper: 0.59 % Gold: 0.12 g/t (First Quantum 2019b)	Priester et al. (2019) indicate that copper grades between 0.5 and 3 % Cu are considered average. Accordingly, the environmental hazard potential caused by the ore grade is medium.	Medium	A = high, can be derived directly from available data

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Hard rock open pit mining (Gray et al. 2015 p. 11)	During open pit mining in solid rocks, the mining activities are restricted to the	Medium	A = high, can be derived directly

		horizontal and vertical extension of the ore body/mineralized zone. The impact is higher than in underground mining but less pronounced then in mining of alluvial or unconsolidated sediments. Hence, conventional solid rock open pit mining is evaluated with a medium EHP.		from available data
Use of auxiliary substances	Mining is carried out with electric and diesel/hydraulic excavators and haul trucks (Gray et al. 2015 p. 11). Sulphide ore is processed by crushing, milling and floation circuits to produce copper in concentrate. Mixed ores are treated via crushing, milling, flotation, sulphuric acid leaching and solvent-extraction and electrowinning to produce gold bearing flotation concentrate and EW cathode copper production (Gray et al. 2015 p. 11; Mining Technology n.d.).	The processing of the sulphide and oxide ore involves a flotation process where potentially toxic reagents are added. In addition, the leaching (SXEW) activity involves toxic agents (in this case by sodium hydrosulphide). Therefore, a High EHP is awarded.	High	A = high, can be derived directly from available data
Mining waste	The surface waste dumps have a capacity of 855 M m3 , and the North West pit after exhaustion of ores is expected to take another 500 M m3. Tailings are disposed in two tailings storage facility, close to the mine site (TSF1 and TSF2). At the end of 2017, roughly 188 Mt of tailings had been deposited in TSF1 while 65Mt tailings in TSF2 are stored in TSF2. The dam can reach a maximum extension of 6,5km^2 (First Quantum 2019a p. 19).	The disposal of waste in high-volume ponds or dams are evaluated with a high EHP.	High	A = high, can be derived directly from available data
Remediation measures	Disturbed land is rehabilitated by First Quantum during the mining activities. Furthermore, there is a community-based	The EHP is determined as low due to the ongoing recultivation and compensation	Low	A = high, can be derived directly

	wildlife conservation program which aims to reintroduce endemic flora and fauna to the concession area (First Quantum 2010 p. 19). Kansanshi contributes to an Environmental Protection Fund administered by the Zambian Mines Safety Department. A mine closure plan is in place and is reviewed annually (Gray et al. 2015 p. 32). Closure costs are also included in the company's cash flow modelling. The main issue at closure will be linked to the dismantling and closure of process plants (First Quantum 2019b).	activities concomitantly to the mining process.		from available data

Framework conditions natural environment

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Accident hazard due to floods, earthquake, storms, landslides	The rating system for the 4 sub-indicators uses georeferenced data from publicly available risk maps (see measurement instructions (Dehoust et al. 2017)). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	For the Kansanshi mine there is a high EHP for flooding events which determines the evaluation result. The EHP for the other sub-indicators is low.	High	A = high, can be derived directly from available data
Water Stress Index (WSI) und desert areas	The WSI by Pfister et al. (2009) provides characterization factors on the relative water availablility at watershed level. Absolute water shortages in dry areas is	The water stress in the mining area is low and the mine is not situated in a desert area, which results in a low EHP.	Low	A = high, can be derived directly from available data

	supplemented by desert areas. The highest hazard level of the sub-indicators determines the total result.			
Protected areas and AZE sites	Georeferenced data for designated protected areas are used to assess hazards posed by mining extraction. The metric to evaluate EHPs corresponds to the method first described in the draft standard of the Initiative for Responsible Mining Assurance (IRMA 2014).	The mine is not situated in designated protected areas and AZE sites, which results in a low EHP.	Low	A = high, can be derived directly from available data

State Governance

Indicators	
WGI 1 -Voice and Accountability	35.96 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	50.48 °°°
WGI 3 - Government Effectiveness	28.85 °°°
WGI 4 -Regulatory Quality	33.65 °°°
WGI 5 - Rule of Law	41.35 °°°
WGI 6 -Control of Corruption	35.58 °°°

EPI (Environmental Performance Index)	50.97
EITI membership	Meaningful progress
International Agreements	
ILO 176	Ratified and in force since 04 Jan 1999
Others	No information obtained
Legal framework	

Areas of Law: Environment	Mining rights holders require an approved environmental authorization issued by The Zambian Environmental Management Agency (ZEMA). Moreover a waste management license is required to handle hazardous wastes. Mines are only to be closed once a certificate of abandonment is granted. This requires identification of insurance and indemnities. However, liability remains with the holder of the mining license (Silwamba / Jalasi 2018). Environmental Impact Assessments of mines are a requirement and are managed by the Zambian Environment Management Agency (ZEMA). The process involves mandatory public consultations with government agencies, local authorities, NGO s, CSOs and interested parties (Environmental Council of Zambia n.d.; MineHutte 2019). The Environmental Management Act is fundamental to environmental standards in the mining sector (Rüttinger et al. 2014).
Areas of Law: Occupational Health and Safety (OHS)	Health and safety are governed by the Mining Regulation 1971 and 1973 and are complemented by the Guide to the Mining Regulations booklet. Owners, employers, managers and employees are imposed with obligations regarding health and safety (Silwamba / Jalasi 2018). The Mines Saftey Department within The Ministry of Mines and Minerals Development is responsible for health and safety matters of all employees in the mining sector (MineHutte 2019).

Corporate Social Responsibility (CSR)

Voluntary Standards	
Aluminium Stewardship Initiative (ASI): Is the mine owning company a member?	Not applicable Not applicable
Aluminium Stewardship Initiative (ASI): Is the mine certified?	Not applicable Not applicable
International Council of Mining & Metals (ICMM): Is the mine owning company a member?	No No (ICMM 2019)
Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?	Yes Yes (MAC 2019)
Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?	No information available No information obtained
Initiative for Responsible Mining Assurance (IRMA): Is the mine owning company a member?	No No (IRMA 2018)
Initiative for Responsible Mining Assurance (IRMA): Is the mine certified?	No No (IRMA 2018)
Responsible Copper (RC): Is the mine owning company a member of RC?	No information available No information obtained
Responsible Copper (RC): Is the mine certified?	No information available No information obtained
Responsible Mining Index (RMI): Has the mine been rated?	Not applicable Not applicable
Responsible Mining Index Company indicator „Working conditions“	Not applicable Not applicable (RMI 2018)

Responsible Mining Index Company indicator „Environmental sustainability“	Not applicable Not applicable (RMI 2018)
Responsible Steel (RS): Is the mine owner a member of the RS?	Not applicable Not applicable
Responsible Steel (RS): Is the mine certified?	Not applicable Not applicable
Australian Steel Stewardship Forum (ASSF): Is the owner a member of the ASSF?	Not applicable Not applicable
Australian Steel Stewardship Forum: Is the mine certified?	Not applicable Not applicable
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (First Quantum 2019b)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (Canada)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (Canada) (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information obtained
Banking Standards	
WB Standards / IFC Performance Standards: Is the mine financed to a major extend by the world bank?	No information obtained No information obtained
Equator Principles (EP): Is the mine financed to a major extend by a bank adherent to the EP?	No information obtained No information obtained

*by companies own account.

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A Glossary

Table 1 Legend

Environmental hazard potential

low

medium

high

Data quality

low

- No concrete information, no general specifications of the measurement instructions, expert estimation.
- Assessment not possible due to lack of data at the site, as there is also no evidence for an assessment and there are no generalized assessment rules.

medium

- Assessable on the basis of available information.
- Generalized classification according to measurement instructions.

high

- Can be derived directly from available data.

B Abbreviations

EHP	Environmental hazard potential
FY	Financial year
kt	Kilo tonnes
m a.s.l.	Meters above sea level
Mt	Million tonnes
OHS	Occupational Health and Safety
t	tonnes
TSF	Tailing Storage Facility
WGI	World Governance Indicators
WHS	Work Health and Safety

C Imprint

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Section III 2.2

PO Box 14 06

06813 Dessau-Rosslau, Germany

Tel: +49 340-2103-0

info@umweltbundesamt.de

www.umweltbundesamt.de

Contact:

Jan Kosmol – jan.kosmol@uba.de

Contractor:

Projekt-Consult GmbH

Eulenkrugstrasse 82

22359 Hamburg, Germany

T +49 (40) 60306-740

F +49 (40) 60306-199

www.projekt-consult.de

Contact:

Dr. Aissa Rechlin – aissa.rechlin@projekt-consult.de

Christopher Demel – christopher.demel@projekt-consult.de

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