ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Polkowice-Sieroszowice

KGHM Polska Miedź S.A., Poland

ID: 54

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

Polkowice-Sieroszowice

Copper

General information

Indicator or criteria	Description and values
Name of mine	Polkowice-Sieroszowice
Description of mining area	The Polkowice-Sieroszowice underground mine is located in Lower Silesia, the main production shaft is west of the town of Polkowice. Polkowice started production in 1968 and Sieroszowice in 1980, in 1996 the two mines were merged (KGHM 2018). Polkowice-Sieroszowice is a Kupferschiefer deposit with the main ore minerals pyrite, chalcopyrite, bornite, covellite, chalcosite, galena and sphalerite (University Jena 2012).
Surface extension	2km^2 2.00 km^2 (Image date: 24.08.2017; Viewing height: 0.83 km) (Google Earth)
In operation since	1968 1968 (KGHM 2019a)
Operator	KGHM Polska Miedź S.A.
Owner	KGHM Polska Miedź S.A.
Closest town	The closest larger town is Głogów, ca. 20 km north of the mine
Province	Lower Silesia
Country	Poland
Longitude	16.066266°
Latitude	51.486492°
Altitude	180 m a.s.l. 180 m a.s.l. (Google Earth)
Main product and by-products	Main product: Copper; By-product: salt, silver, nickel, lead, gold (KGHM 2019a)

On-site processing stages	Crushing, screening, two stages of closed-circuit grinding and classification, flotation, generally with re-grinding of the rougher concentrate followed by thickening, filtration and drying of the concentrate (Bartlett et al. 2013).
Annual production	204.6 kt Cu (KGHM 2018)
Proven Reserves	116,316 kt of ore Cu 1.8 % and 31.70 g/t Ag (2,096 Kt of Cu & 3,686,442 kg of Ag) (KGHM 2015)
Probable Reserves	314.223 kt of ore Cu 1.84 % and 50.10 g/t Ag (5,789 Kt of Cu & 15,729,171 kg of Ag) (KGHM 2015)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	A chemical analysis of the flotation tailings indicates that 0.9 % of the tailings are sulphides (Kotarska 2012).	Since the tailings contain sulphides, preconditions for Acid Mine Drainage are met, resulting in a high EHP for the indicator.	High	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	Chemical analysis shows that copper (0,23 %), lead (0,03 %), zinc (0,01 %), arsenic (20 g/t), and cobalt (6 g/t) are present in the flotation tailings (Kotarska 2012).	The main product copper is defined as a heavy metal, moreover other heavy metals are present in the tailings resulting in a high EHP for the indicator paragenesis with heavy metals.	High	A = high, can be derived directly from available data

Paragenesis with radioactive components	An analysis of the radiological hazard potential in the mines concludes that the radiological risk is low (the study was financed by KGHM). E.g. Potassium 40 shows an average activity of 0.64 Bq/g in Polkowice and 0.35 Bq/g in Sieroszowice. Radium 224, 226 and 228 show an average activity of 0.23 Bq/g in both mines. Miners are exposed to an average between 0.5 and 1.5 mSv of ionizing radiation per year (Jodłowski et al. 1996).	Radiological hazard analysis in the mines shows that the radiation is similar to background levels. The authors of the study conclude that the mining activity is not leading to elevated radiation levels. Ionizing radiation threshold values for people working in the mining sector is 20 mSv per year – levels measured in the mines are well below the threshold (Jodłowski et al. 1996). Accordingly, the EHP resulting from paragenesis with radioactive components is low.	Low	C = low, no concrete information, no general specifications in the measuring instructions, (expert) estimate
Deposit size	Polkowice started production in 1968 with a production capacity of 4.5 Mt in the first 4 years and 7.5 Mt of ore in the fifth year of operation. In 1980 Sieroszowice started production. Until the opening of Sieroszowice, an estimated (current Cu grade of 2.3 % assumed) total of 1.8 Mt of copper were produced in Polkowice. Calculating with the current production capacity of 12 Mt ore at a Cu grade of 2.3%, Polkowice-Sieroszowice produced ca, 10 Mt of copper (KGHM 2019a). Current total reserves add up to almost 8 Mt of copper (KGHM 2015). In total the deposit size could amount to roughly 20 Mt of copper.	The deposit size is very large according to Petrow. Larger deposits potentially have a greater expected total impact on the natural environment. Considering the estimated production and the remaining resources Polowice-Sieroszowice's EHP resulting from the deposit size is high.	High	B1 = medium, can be estimated on the basis of available information
Ore grade	2.30 % Cu (KGHM 2019a)	According to Priester et al. (2019) copper grades between 0.5 and 3 % Cu are average grades. Accordingly, the EHP resulting from the specific 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	Underground mining (KGHM 2019a)	Underground mining operations disturb a rather small surface area compared to other types of mining. Accordingly the EHP resulting from the mining method is low.	Low	A = high, can be derived directly from available data
Use of auxiliary substances	Conventional crushing, grinding and flotation processes (Bartlett et al. 2013).	The process involves a flotation circuit where potentially toxic reagents are used. Therefore extraction and processing pose a high EHP.	High	C = low, no concrete information, no general specifications in the measuring instructions, (expert) estimate
Mining waste	Flotation tailings are stored as a slurry, in the tailings storage facility (TSF) "Żelazny Most". Żelazny Most is a structure with a perimeter of more than 14 kilometres that covers an area of approximately 1,400 hectares. It is reported to be the largest tailings storage facility in Europe (Bartlett et al. 2013). The dam height varies between 27 and 66 m depending on the topology (Skau et al. 2013).	The tailings storage facility called Żelazny Most is a very large strucure. The dam exceeds heights of 30 m qualifying the structure as a Large Dam according to ICOLD (2011). Accordingly, the mining waste management poses a high EHP.	High	A = high, can be derived directly from available data

Remediation measures	A mine closure fund is maintained since 1994 and is already being used for progressive restoration at some sites (Bartlett et al. 2013).	Progressive rehabilitation is applied. Accordingly, the EHP resulting from remediation measures- is low.	Low	A = high, can be derived directly 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. 2017b)). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	All other sub-indicators show a low EHP for all six sites of the mine, which results in a low EHP.	Low	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 supplemented by desert areas. The highest hazard level of the sub-indicators determines the total result.	The EHP for water stress 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
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	The mine site 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

	Initiative for Responsible Mining Assurance (IRMA 2014).			

State Governance

Indicators

WGI 1 -Voice and Accountability	72.91 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	64.76 °°°
WGI 3 - Government Effectiveness	74.04 °°°
WGI 4 -Regulatory Quality	78.85 °°°
WGI 5 - Rule of Law	68.27 °°°
WGI 6 -Control of Corruption	75.96 °°°
EPI (Environmental Performance Index)	64.11
EITI membership	No

International Agreements

ILO 176	Ratified since 2001
Others	OECD member
Legal framework	
Areas of Law: Environment	Polish Mining Law is primarily regulated by the Geological and Mining Law from 2011. Mining is also affected by the Environmental Protection Law from 2001 (Given 2019). If mining projects have a significant impact on the environment, an environmental impact assessment will always be required in accordance with the relevant Act of dated from 3 October 2008 also public participation is required (Blachowski et al. 2017). Applications for concessions must contain information concerning countermeasures for negative impacts on the environment. The storage of waste and tailings requires a waste management plan that is approved by a local authority. Among other requirements the production of waste must be minimised, process water must be reused whenever possible, different wastes must be stored separately etc. Disposal facilities require a formalised risk assessment. A fund for closure needs to be established by the mining right holder that is only to be used for the required re-cultivation of land, liquidation of excavations and undertaking of measures to protect the environment (Given 2019). The relevant authorities include the Ministry of Environment and the Ministry of Energy. According to the new mining law now the Ministry of Energy is responsible for overseeing the State Mining Authority and is responsible for the management of mineral resources (MinGuide 2016).

Areas of Law: Occupational Health and Safety (OHS)	Health and Safety laws are implemented through the Polish Labour Code. Mining and underground mining in particular are supplemented by specific regulations issued by the Minister of Energy and certain regulation by the Minister of Economy. In accordance with the Polish Labour Code employers are responsible for ensuring healthy and safe working conditions, preventing accidents, informing their employees about occupational risks and providing free protection equipment (Given 2019; Krzemień / Krzemień 2013).

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)?	No No (MAC 2019)
Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?	Not applicable Not applicable

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 available.
Responsible Copper (RC): Is the mine certified?	No information available No information available.
Responsible Mining Index (RMI): Has the mine been rated?	No No (RMI 2018)
Responsible Mining Index Company indicator „Working conditions“	No No (RMI 2018)
Responsible Mining Index Company indicator „Environmental sustainability“	No No (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?	No No (KGHM 2019b)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes (KGHM 2019c)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information available
Banking Standards	
WB Standards / IFC Performance Standards: Is the mine financed to a major extend by the world bank?	No information obtained No information available
Equator Principles (EP): Is the mine financed to a major extend by a bank adherent to the EP?	No information obtained No information available

*by companies own account.

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A Glossary

Table 1 Legend

Environmental hazard potential

 *low*	 *medium*	 *high*

Data quality

 *low*	 *medium*	 *high*
• 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.	• Assessable on the basis of available information. • Generalized classification according to measurement instructions.	• 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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