ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Zhezkazgan Copper Mine

KAZ Minerals , Kazakhstan

ID: 64

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

Zhezkazgan Copper Mine

Copper

General information

Indicator or criteria	Description and values
Name of mine	Zhezkazgan Copper Mine
Description of mining area	The Zhezkazgan mining complex includes the North (open pit), South (underground), East (underground), and Zhomart (underground) mines. There are also 3 concentrators and 2 smelters in this area (Kazakhmys 2014 p.43). The centre of the Zhezkazgan complex is located ca. 400 m a.s.l. in the Karaganda Province, around 20 km north-west of the town of Zhezkazgan and ca. 5 km to the west of the town of Satpayev (Porter GeoConsultancy 2013). The region is characterized by a continental climate in a desert and dry steppe environment within the Kazakhstan-North Tien Shan Massif. The mineralised zone is situated on an east-north-east trending dislocation that has a depth of 70 to 80 km. Bornite, chalcopyrite and chalcocite are present copper bearing minerals in the sulphidic zone. A smaller oxide zone is mainly composed of malachite, azurite and chrysocolla (Porter GeoConsultancy 2013).
Surface extension	0.2km² 0.20 km² (Image date: 1.5.2019; Viewing height: 1.13 km Google Earth)
In operation since	1971 1971 (Sulphuric Acid on the Web 2009)
Operator	KAZ Minerals
Owner	KAZ Minerals
Closest town	Zhezkazgan (Google Maps)
Province	Karaganda Province
Country	Kazakhstan
Longitude	67.472814°

Latitude	47.88346°
Altitude	419 m a.s.l. 419 m a.s.l. (Google Earth 2019)
Main product and by-products	Main product: copper, by-products: gold, silver (KAZ Minerals 2016)
On-site processing stages	Crushing, grinding, flotation (Kazakhmys 2014 p. 45)
Annual production	210,000 t copper cathodes, 25,600Mt of ore (KAZ Minerals 2016)
Proven Reserves	82 Mt, 0.61 % Cu (Kazakhmys 2014 p. 50)
Probable Reserves	157.5 Mt, 0.61 % Cu (Kazakhmys 2014 p. 50)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Copper is a chalcophilic element. Chalcophilic elements are often obtained from sulphidic deposits, which are particularly prone to AMD. At Zhezkazgan, copper is mined from sulphides and oxides (Yun 2016).	The extraction of sulphidic minerals has a high environmental hazard potential with regard to AMD.	High	A = high, can be derived directly from available data
Paragenesis with heavy metals	Copper is a heavy metal and moreover often associated with zinc, lead, iron, nickel and arsenic. No concrete information about the occurrence of heavy metals could be found.	Since copper itself is considered to be a harmful metal to the ecosystem and human health,, the extraction of copper is evaluated with a high environmental hazard potential (EHP).	High	A = high, can be derived directly from available data

Paragenesis with radioactive components	No indication of paragenesis with thorium (Th) and uranium (U) could be determined.	In accordance with the measurement instructions, copper ore deposits are evaluated with a medium EHP, if no other information is available..	Low	B2 = medium, classified according to measurement instructions
Deposit size	Total reserve: 360 Mt of ore with an average ore grade of 0.73% (KAZ Minerals 2013 p. 164)	Considering the total reserves of 360.0 Mt of copper ore and adding the amount of copper ore extracted in the past (1945: 73 years - with an estimated average of 150.000 t/year = 11 Mt), the total deposit size sums up to approximately 371 Mt. Assuming an average grade of 0.73 % copper, the total copper amounts to about 2.7 Mt. According to the measurement instructions, the complex is classified as medium size and evaluated with a medium EPH.	Medium	A = high, can be derived directly from available data
Ore grade	0.73 % Cu (KAZ Minerals 2013 p. 163)	With an ore grade of 0.73 %, Zhezkazgan deposit can be assessed as an average grade deposit.	Low	A = high, can be derived directly from available data

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality

Mine type	Underground mines	The extraction method used in mining gives an indication of the interventions at the earth's surface necessary for the extraction of the raw material. These are naturally lowest in underground 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	Underground mining is carried out with underground trucks, LHD loaders (load-haul-dump machine) and tipping cars with material transported to the surface with cars through lifting tunnel. Ore from the mines in the Zhezkazgan Region is conveyed via railway network to the concentrators in Zhezkazgan (Kazakhmys 2014 p. 45). After primary, secondary and tertiary crushing, the material is transported to the solvent-extraction and electrowinning plant were the copper cathodes are produced (Yun 2016).	Solvent-extraction is often conducted with the help of toxic additives such as chemical solvents, leading to a high EHP in the evaluation result.	High	A = high, can be derived directly from available data
Mining waste	The waste heaps at Zhezkazgan contain 870Mt of tailings and 21Mt of sludge. The waste dumps are formed in the outskirts of the underground mining areas also serving a function of wind protection barriers. The waste rock is used as backfill material. Low grade ore material (oxide ore) is stored separately from waste rock. TSF No.1 has been conserved but is not in use any longer. Its size is 12.5 km in perimeter (along the dam) and highest dam point is 69.5 m. TSF No.2 is still in use (Yun 2016).	Due to the height and the surface extension of TSF 1 and the additional presence of TSF 2, the EHP is classified as high in accordance with the measurement instructions.	High	B = medium, classified according to measurement instructions

Remediation measures	TSF No.1 at Zhezkazgan has been revegetated by 80% in 2015. Kazakhmys monitors its emissions and in recent years has invested in reducing its environmental emissions. Programs to protect endemic vegetation and regionally wildlife are conducted by the company. Closure plans and finances for all sites of Kazakhmys are in place (KAZ Minerals 2013).	The EHP is determined as low due to the ongoing recultivation and compensation activities concomitantly to the mining process.	Low	B = medium, classified according to measurement instructions

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.	The EHP for all sub-indicators (earthquakes, flood, landslide, tropical storm, arctic region) is low.	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 but the mine is situated in a dry steppe region. This result alone already determines the high EHP result.	High	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 Initiative for Responsible Mining Assurance (IRMA 2014).	The identified site of the mining complex 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	15.76 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	45.71 °°°
WGI 3 - Government Effectiveness	54.33 °°°
WGI 4 -Regulatory Quality	60.1 °°°
WGI 5 - Rule of Law	35.58 °°°
WGI 6 -Control of Corruption	36.06 °°°
EPI (Environmental Performance Index)	54.56

EITI membership	Meaningful progress
International Agreements	
ILO 176	No
Others	None
Legal framework	
Areas of Law: Environment	The Ministry of Investment and Development (the "MID") regulates solid minerals contracts and regulates the mining industry through its subordinate, the Committee on Geology and Subsoil Use. The most important legislation for environmental aspects of mining activities is the Law on Subsoil and Subsoil Use, especiallyArticle 109 of this law. It is necessary for "subsoil users" to submit preliminary project documentation, and project documentation for State ecological and sanitary-epidemiological examinations. Moreover, environmental impact assessments and an environmental protection section is required. Mine closure must be conducted on the basis of a liquidation or conservation plan that has been (i)" developed by a licensed project company, (ii) agreed to by authorities in the fields of environmental protection, study and use of subsoil, industrial safety, sanitary-epidemiological service, land resources management, and (iii) approved by the subsoil user". Mining companies are obliged to work on liquidation and conservation of the operation, immediately after termiantion of mining activities (Yerkebulanov 2015).

Areas of Law: Occupational Health and Safety (OHS)	Most requirements for employers and employees in relation to health and safety can be found in Article 115 (Ensuring Subsoil Use Conditions Safe for Population and Staff) of the Subsoil Law. These include, e.g., equipment, protective clothes, air quality monitoring and prohibition of life-threatening tasks. There has to be a specialised person in each mining company which is responsible for health and safety. Workers who are directly involved in potentially dangerous activities must regularly pass several safety certifications and tests (Yerkebulanov 2015)

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*?	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?	No No (RMI 2018)
Responsible Mining Index Company indicator „Working conditions“	Not rated Not rated (RMI 2018)
Responsible Mining Index Company indicator „Environmental sustainability“	Not rated Not rated (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 information obtained No information obtained

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No
OECD Guidelines: Does the company have its headquarters in a signatory state?	No No
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	*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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