ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Erdenet Copper Mine

State of Mongolia/Erdenet, Mongolia

ID: 69

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

Erdenet Copper Mine

Copper

General information

Indicator or criteria	Description and values
Name of mine	Erdenet Copper Mine
Description of mining area	Erdenet is an open-pit copper mine in the north of Mongolia, ca. 400km northwest of Ulaanbaatar. The mine borders directly to the settlement of Erdenet and is situated in a hilly part of northern-central Mongolia (Google Maps). This area is characterized by forest steppe vegetation and a dry continental climate and moderate precipitation (WWF 2018). As located in the Orkhon-Selenge volcano-sedimentary, the Erdenet porphyry Cu-Mo deposit is part of the Mongolian magmatic belt consisting of late paleozoic to mesozoic volcanic structures. The mine produces copper mainly from a chalcocite blanket which contains bornite-covellite-chalcocite. Other copper-bearing minerals are pyrite, chalcopyrite and different oxidic minerals (Porter GeoConsultancy n.d.).
Surface extension	57.33km^2 57.33 km^2 (Image date: 26.6.2019; Viewing height: 8.74 km) (Google Earth)
In operation since	1977 1977 (Porter GeoConsultancy n.d.)
Operator	Erdenet Mining Corporation SOE
Owner	State of Mongolia/Erdenet
Closest town	Bayan-Undur Soum, (400 km northwest of Ulaanbaatar) (Australian Government 2015 p. 28).
Province	Orkhon Province (Australian Government 2015 p. 28)
Country	Mongolia
Longitude	104.133941°
Latitude	49.019329°

Altitude	1436 m a.s.l. 1436 m a.s.l. (Google Earth 2019)
Main product and by-products	Main product: copper; by-product: molybdenum (Australian Government 2015 p. 28)
On-site processing stages	Crushing, grinding, flotation, filtration drying (Erdenet 2019a)
Annual production	approx.. 530.000 t of copper concentrate (Erdenet 2019b)
Proven Reserves	1.5 Mt (total reserve) (ERI 2017 p. 25)
Probable Reserves	1.5 Mt (total reserve) (ERI 2017 p. 25)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The chalcophile element Copper is mainly extracted from sulphidic deposits, which pose a high risk for AMD. At Erdenet, the ore is mainly extracted from a chalcocite-blanket and therefore, particularly prone to AMD (Porter GeoConsultancy n.d.)	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	Samples of lichens, tree bark and dust from the Erdenet area have shown contamination of the mine environment by heavy metals (manganese, zinc, nickel, lead, iron, copper, cobalt). Especially the copper levels decrease with an increasing distance to the copper mine, which indicates a mine-related air pollution in the research area (Ziadat et al. 2015 p. 6).	Since copper itself is considered to be a harmful metal to the ecosystem and human health, the measurement instructions suggest a high 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	The total reserve of Erdenet amounts ca. 1.5 Bt ore with an average ore grade 0.44 % Cu (resulting in a metal content of 6.6 Mt of copper)(ERI 2017 pp. 25–27)	From 1978 to 2015, 15.4 Mt concentrate were produced in Erdenet, by 2018 it can be estimated at 17.4 (with an annual production of approx. 500,000 t). The concentrate's copper grade at Erdenet is 23% which leads to an amount of 3.9 Mt of copper metal produced in Erdenet. Combined with the metal content (6,6 Mt) of the current reserve, the deposit has a total content of 10.5 Mt of copper. The deposit is classified as very large sized and, hence, is evaluated with a high EHP.	High	A = high, can be derived directly from available data
Ore grade	0.44% Cu (ERI 2017 p. 55)	With a copper content of 0.44 %, the deposit can be assessed as low grade deposit.	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 mine (ERI 2017 p. 55)	Conventional solid rock open pit mining is evaluated with a medium EHP. During open pit mining in solid rocks, the mining activities are restricted to the 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.	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	The concentration plant includes circuits for ore crushing, grinding, flotation and filtration drying. Waste material from the processing stage is conveyed to the tailings pond. In the future, erdenet's processing plant will have a capacity of 35 Mt per year (currently 25 Mt) (Erdenet 2019c).	Flotation is often conducted with the help of toxic additives such as organic hydrocarbons, leading to a high EHP in the evaluation result.	High	A = high, can be derived directly from available data
Mining waste	Erdenet's tailings pond covers an area of 1712.8 hectares.	The disposal of waste in large tailing ponds or dams are evaluated with a high EHP.	High	B = medium, classified according to measurement instructions
Remediation measures	Since 2007, Erdenet Mining Corporation SOE is conducting rehabilitation at one zone (bare rock heap Nr.3) of the open pit. More than 15.000 trees and bushes were planted for rehabilitation of the devastated areas) (Erdenet 2019c).	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 Erdenet Copper mine has a medium EHP for earthquakes which determines the evaluation result. The other sub-indicators have a low EHP.	Medium	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 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
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	56.16 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	74.76 °°°
WGI 3 - Government Effectiveness	42.31 °°°
WGI 4 -Regulatory Quality	50.96 °°°
WGI 5 - Rule of Law	41.83 °°°
WGI 6 -Control of Corruption	41.83 °°°
EPI (Environmental Performance Index)	57.51
EITI membership	Satisfactory progress
International Agreements	
ILO 176	Yes

Others	No further information obtained.
Legal framework	
Areas of Law: Environment	The most significant mining legislation in Mongolia is the Environmental Impact Assessment Law (EIAL) which determines the environmental impact assessment (EIA) process. Moreover, the Minerals Law (ML) and the Environment Protection Law (EPL) regulate the EIA process (MineHutte 2019). At national level, the Ministry of Environment and Tourism (MET) is responsible for EIAs and their management whilst at regional level, the responsibility lies with provincial governors. These governors are an important authority with regard to exploration activities (see MineHutte 2019 for more information). Mining license holders must have EIAs conducted to identify all possible social and environmental impacts of the extraction. The documents to be handed in to obtain permission for an EIA, must be submitted to the MET and include a description of the project, a feasibility study, the engineering drawing and design among others. In a next step, the responsible authority has to develop Environmental Management Plans (EMP) to provide measures for mitigation and prevention of environmental impacts (see (MineHutte 2019) for more information).

Areas of Law: Occupational Health and Safety (OHS)	Mongolia has ratified the ILO Convention 176 on Safety in Health on Mines in November 2015 (ILO 2017). Mining license holder must submit Health and Safety Reports annualy to the Mineral Resources and Petroleum Authority of Mongolia (MRPAM) (MineHutte 2019). The Law of Safety and Hygiene deals with health and safety issues in Mongolia`s mining sector. Any mining project has to comply with the Law of safety and hygiene and mining license holders must carry out measures to improve the health and safety standards in their projects. These include: measures to prevent accidents with toxic substances and explosives, risk evaluations, trainings for employees, medical check-ups, provision of protective equipment and more (ILO 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)?	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?	Not applicable Not applicable
Responsible Copper (RC): Is the mine certified?	Not applicable Not applicable
Responsible Mining Index (RMI): Has the mine been rated?	No No (RMI 2018)
Responsible Mining Index Company indicator „Working conditions“	Not applicable Not applicable
Responsible Mining Index Company indicator „Environmental sustainability“	Not applicable Not applicable
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 (Erdenet 2019b)

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