

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Toromocho Copper Mine

Aluminium Corp of China Ltd (CHALCO) , Peru

ID: 53

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.

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

Toromocho Copper Mine

Copper

General information 	
Indicator or criteria	Description and values
Name of mine	Toromocho Copper Mine
Description of mining area	The copper-polymetallic mine is located in the Morococha mining district. The ore body is known to be complex, with a range of veins, veinlets, stock works, “manto-type” bodies and disseminated sulphides of the general “porphyry copper” mineralisation, hosted in intrusive and contact metamorphic units. Chalcopyrite and chalcocite form the majority of the copper mineralisation. Molybdenum and Silver are present as by-products. The processing plant is a semi-autogenous grinding /ball mill/flotation plant (Behre Dolbear 2012)
Surface extension	64.41km ² 64.41 km ² (Image date: 25.07.2019; Viewing height: 19.13 km) (Google Earth)
In operation since	2013 2013 (BNamericas 2015)
Operator	Minera Chinalco Peru S.A.
Owner	Aluminium Corp of China Ltd (CHALCO)
Closest town	2.5 km from Morococha, which is a mining based town.
Province	Yauli Province
Country	Peru
Longitude	-76.140617°
Latitude	-11.61939°
Altitude	4770 m a.s.l. 4770 m a.s.l. (Google Earth)

Main product and by-products	Main Products: Copper; By-product: Molybdenum; Silver (Mining Data Online 2019)
On-site processing stages	Flotation takes place on-site (Mining Data Online 2019)
Annual production	218,383 t Cu in copper concentrates in 2015 (CHINALCO 2016) Annual capacity according to operator: 1 Mt copper concentrate; By product: 10,000 t Molybdenum; 4 Moz. Silver Oxide (Minera Chinalco Peru 2009)
Proven Reserves	Copper: 3.53 Mt contained metal (0.512 %); Moly: 138,000 t contained metal (0.02%); Silver: 4,400 t contained metals (6.42 g/t) - (CHINALCO 2016)(Mining Data Online 2019)
Probable Reserves	Copper: 3.4 Mt contained metal (0.434 %); Moly: 141,000 t contained metal (0.018%); Silver: 5,700 t contained metals (7.31 g/t) - (CHINALCO 2016)

Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The polymetallic deposit at Toromocho includes a chalcocite and covellite enrichment as well as a sulphate zone containing anhydrite disseminations (Behre Dolbear 2012)	Since sulphide minerals are present a high EHP results for preconditions for acid mine drainage (AMD)	High	A = high, can be derived directly from available data
Paragenesis with heavy metals	There is confirmed presence of heavy metal in the discharge of the mine, requiring a water treatment plant to be installed. There are also indications for high-grade arsenic presence in certain segments of the ore body (Behre Dolbear 2012). Copper concentrates produced in 2015 contained levels above 0.5 % of arsenic (CHINALCO 2016).	Copper is a heavy metal itself. Moreover, significantly elevated arsenic levels are present Toromocho leading to a high EHP for paragenesis with heavy metals.	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 (USGS 2015).	Low	B2 = medium, classified according to measurement instructions
Deposit size	The mine had its first year of full production in 2015 and produced ca. 0.2 Mt of copper. So to date approximately 0.8 Mt have been produced, adding the reserves the deposits adds up to a total volume of ca. 8 Mt (CHINALCO 2016).	The deposit size is large according to Petrow et al. Accordingly, the deposit size poses a high EHP.	High	A = high, can be derived directly from available data
Ore grade	0.512 % (CHINALCO 2016)	According to Priester et al. deposits with grades between 0.5 and 3 % Cu are average. The Cu grade at Toromocho is very close to the threshold for low grade but still within the range of average grade classification. Accordingly, the EHP resulting from 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	Mining is done by conventional truck-and-shovel open pit mine, for hard rock (Behre Dolbear 2012).	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 than in mining of alluvial or unconsolidated sediments.	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	A flotation processes for copper and separately for molybdenum is indicated, with no clear information on what substances are used in the flotation process (Behre Dolbear 2012).	Generally, flotation is often conducted with the help of toxic additives such as organic hydrocarbons. Therefore, a high EHP exists here.	High	B1 = medium, can be estimated on the basis of available information
Mining waste	The project design includes two waste-rock deposits with a capacity of 1.6 billion tonnes of waste rock. As for tailings, a 55% solid tailings is envisaged at the concentrator, with past thickeners added to the slurry to produce in excess of 89 % solids for deposition. (Behre Dolbear 2012). The tailings storage facility is planned to store 1 billion tons of tailings over the life of mine (SNC-Lavalin Chile S.A 2006).	Given the volume to be contained in the TSF a High EHP is awarded for mining waste management.	High	B1 = medium, can be estimated on the basis of available information
Remediation measures	The planned reclamation and closure plan provided by the company in the EIA is expected to be reviewed every 5 years, with a financial assurance bond to be revised at the time of each review. The conceptual plan is noted to be good, however no information on parallel remediation activity currently taking	Since financial commitments to closure are outlined, a medium EHP is awarded.	Medium	A = high, can be derived directly from available data

	place could be identified (Behre Dolbear 2012).			
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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. 2017a)). 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 earthquakes is high and the EHP for landslides is medium. The other sub-indicators have a low EHP. Due to the high EHP for earthquakes, the overall EHP is also high.	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 availability 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 high but the mine is not situated in a desert area, resulting in a high EHP.	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 mining area 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	55.17 ^{ooo}
WGI 2 -Political Stability and Absence of Violence/ Terrorism	36.19 ^{ooo}
WGI 3 - Government Effectiveness	48.56 ^{ooo}
WGI 4 -Regulatory Quality	67.31 ^{ooo}
WGI 5 - Rule of Law	33.17 ^{ooo}
WGI 6 -Control of Corruption	38.94 ^{ooo}
EPI (Environmental Performance Index)	61.92
EITI membership	Meaningful progress (EITI 2019)
International Agreements	
ILO 176	Yes

<p>Others</p>	<p>Part of the UN Framework Convention on Climate Change (UNFCCC). Signature of the Paris Agreement on Climate Change and participation at COP 22. COP 20 held in Lima in 2014.</p> <p>Ratification of the Minamata Convention of Mercury in November 2015.</p> <p>Reaffirmation of commitment with the 2030 Agenda for Sustainable Development. (MDNP 2018)</p>
<p>Legal framework</p>	
<p>Areas of Law: Environment</p>	<p>Peru has a detailed and elaborate environmental legislation in the resource sector. Significant laws are the General Environmental Law (GEL), the Environmental Impact Assessment (EIA) Law and the Environmental Regulation for mining and exploration activities, among others (see MineHutte n.d.) for more information).</p> <p>An EIA needs to be carried out for all activities that may lead to significant impact on the environment. Activities are categorized, according to their foreseen impact. For activities with a middle to high environmental impact, detailed planning is required, including but not limited to management, abandonment, citizen participation and monitoring. Each stage of exploration and exploitation requires a specific type of consent, including environmental consent and public hearings (ibid.).</p> <p>The Ministry of Energy and Mines (MINEM) is the main competent authority for mining and mineral exploration – also for environmental matters. Nonetheless, several more state bodies play a role. Depending on the level of environmental impact, the competent authorities for the approval of an EIA may also be the National Environmental Certification Service for Sustainable Investments (SENACE), or the regional government, for instance (ibid.).</p>

<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>Peru has ratified the ILO Convention 176 on Safety in Health on Mines in June 2008 and subsequently adopted the Supreme Decree No. 024-2016-MS for the Regulation of Occupational Safety and Health in Mining. The Decree applies to mining as much as activities related to the mining sector, such as civil constructions, machinery, equipment and mechanical maintenance (MDNP 2018). The legislation on occupational health and safety (OHS) concerns minimum wages, medical tests and occupational safety for miners (Elias 2018). The Ministerio de Energía y Minas (MINEM) is the competent authority for OHS matters (MDNP 2018). ICGL additionally names the Organismo Supervisor de la Inversión en Energía y Minería (Osinerghmin), the superintendencia nacional de fiscalización laboral (SUNAFIL) and the ministry of labour and employment.</p>
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Corporate Social Responsibility (CSR)

Voluntary Standards	
<p>Aluminium Stewardship Initiative (ASI): Is the mine owning company a member?</p>	<p>No No (ASI 2019)</p>
<p>Aluminium Stewardship Initiative (ASI): Is the mine certified?</p>	<p>Not Applicable Not Applicable</p>
<p>International Council of Mining & Metals (ICMM): Is the mine owning company a member?</p>	<p>No No (ICMM 2019)</p>
<p>Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?</p>	<p>No No (MAC 2019)</p>

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?	Not applicable Not applicable
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 2018a)
Responsible Mining Index Company indicator „Working conditions“	No No (RMI 2018b)
Responsible Mining Index Company indicator „Environmental sustainability“	No No (RMI 2018b)
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 Not identified.

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 No
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 No

*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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- Öko-Institut e.V. (Institute for Applied Ecology)