ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Collahuasi

Anglo American , Chile

ID: 38

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

Collahuasi

Copper

General information

Indicator or criteria	Description and values
Name of mine	Collahuasi
Description of mining area	The Collahuasi mine complex is located on a plateau in the northern Atacama Desert at 4,400 metres above sea level. This part of the Andean area is characterised by a rainy climate in summer and surrounded by vulnerable ecosystems including salt flats and wetlands. Huatacondo is the closest town and ca. 40 km distant from the mine site (Collahuasi n.d. a).
Surface extension	105.01km^2 105.01 km^2 (Image date: 23.12.2018; Viewing height: 19.06 km) (Google Earth)
In operation since	2001 2001
Operator	Compañía Minera Doña Inés de Collahuasi SCM
Owner	Anglo American
Closest town	Calama, 160 km SW of the mine (Google Maps)
Province	El Tamarugal Province, Tarapacá Region (Google Maps)
Country	Chile
Longitude	-68.636944°
Latitude	-20.992777°
Altitude	4000 m a.s.l. 4000 m a.s.l. (Collahuasi n.d. a)
Main product and by-products	Copper, Molybdenum (Glencore 2017)

On-site processing stages	Sulphide ores: crushing, grinding and flotation; Oxide ores: crushing, agglomeration, acid leaching, solvent extraction and electro-winning to produce cathode copper (Mining Technology n.d.).
Annual production	Copper: 506,5 t of fine copper (Collahuasi n.d. b)
Proven Reserves	479 Mt copper ore with an average ore grade of 1.14 % (Glencore 2017).
Probable Reserves	2,740 Mt copper ore with an average ore grade of 0.89 % Cu (Glencore 2017).

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Copper is a chalcophilic element obtained from oxides and sulphides in Collahuasi. The Sulphidic mineralisation in the Ujina and Rosario ore zones poses a high risk for AMD (Dehoust et al. 2017b; Glencore 2017).	According to the ÖkoRess assessment scheme, chalcophilic elements all have a high hazard potential with regard to AMD (red).	High	A = high, can be derived directly from available data
Paragenesis with heavy metals	No information about paragenesis of other heavy metals with copper at Collahuasi could be found. However, a paragenesis of copper with other heavy metals such as lead, zinc, arsenic or nickel often occurs (Dehoust et al. 2017b).	Copper is a heavy metal itself. With reference to the ÖkoRess assessment scheme, the extraction of heavy metals is to be assessed with a high environmental hazard potential.	High	B2 = medium, classified according to measurement instructions

Paragenesis with radioactive components	No indication of paragenesis with thorium and uranium 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	3,220 Mt total sulphidic ore reserves with a copper content of 0.93% (Glencore 2017). The total value metal content of the Collahuasi deposit is roughly 37 Mt of copper. This value results from an estimated annual production (2001-2017, ca. 447,000t per annum) and the metal content of the current total reserves (Collahuasi 2018; Glencore 2017; own calculation).	The Collahuasi deposit provides a total metal content of roughly 32 Mt of copper. According to the site-related ÖkoRess assessment scheme, a deposit of this size is very large and poses a high environmental hazard potential.	High	A = high, can be derived directly from available data
Ore grade	0.93 % average copper ore content (Glencore 2017)	With a copper content of 0.93 %, the Collahuasi deposit can be assessed as an average 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 mining (Collahuasi 2018).	Conventional hard rock mining in an open-pit is assessed with a medium EHP due to its comparatively low land degradation potential.	Medium	A = high, can be derived directly from available data

Use of auxiliary substances	At Collahuasi, the copper ore is mined by conventional truck and shovel methods. There are two plants, an oxide and a sulphide plant in use. The Sulphide ore is crushed, milled and then treated in a flotation unit (Collahuasi 2018). As only a very small amount of oxides is obtained, only sulphide processing is evaluated here.	Flotation is often conducted with the help of toxic additives such as organic hydrocarbons, resulting in a high EHP.	High	A = high, can be derived directly from available data
Mining waste	The tailings are stored in the large Pampa pabellon impoundment. This facility extends over 6 km and the dam wall has a height of 63 m (Consejo Minero 2019).	The disposal of waste in large-quantities and large-scale tailing dams (>15m structural height) is considered with a high environmental hazard potential.	High	A = high, can be derived directly from available data
Remediation measures	The operator of Collahuasi conducts vegetation monitoring and environmental studies parallel to the mining activities. Reforestation measures and wetting projects are carried out (Collahuasi n.d. c). No information was obtained on a particular mine closure plan.	The EHP can be assessed as low due to the re-cultivation and compensation activities during mining.	Low	B1 = medium, can be estimated on the basis of available information

Framework conditions natural environment

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Accident hazard due to floods,	The rating system for the 4 sub-indicators uses georeferenced data from publicly available risk maps (see measurement	High hazard potential for earthquakes due to location in a seismic active area. There is a low risk for floods and storms.	High	B2 = medium, classified according to

earthquake, storms, landslides	instructions). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.			measurement instructions
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.	High hazard potential due to a high WSI and Collahuasi's location in a desert area.	High	B2 = medium, classified according to measurement instructions
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).	Low hazard potential. The mine is not located within a protected or highly protected areas.	Low	B2 = medium, classified according to measurement instructions

State Governance

Indicators

WGI 1 -Voice and Accountability	79.31 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	60.95 °°°
WGI 3 - Government Effectiveness	77.88 °°°

WGI 4 -Regulatory Quality	88.94 °°°
WGI 5 - Rule of Law	81.73 °°°
WGI 6 -Control of Corruption	82.21 °°°
EPI (Environmental Performance Index)	57.49
EITI membership	n.d.
International Agreements	
ILO 176	No
Others	Ratification of the Minamata Convention on Mercury 27.08.2018 (UNEP 2019) Signature of the Paris Agreement on Climate Change (which entered into force on 12.03.2017) (UNFCCC 2016).
Legal framework	

Areas of Law: Environment	The Chilean state is obliged to guarantee a pollution-free environment through environmental legislation. The Environmental Law 19.300 includes the statutory environmental framework and defines that Environmental Impact Assessments (EIA) are mandatory to obtain an environmental license for projects in the mining sector. To these belong, e.g., projects for minerals, oil, gas and coal at different stages of the mine life cycle (exploration to mine closure), (EI SourceBook 2016). The design of the EIAs differ, depending on the potential hazards to a number of social or environmental circumstances. Previous consent of indigenous communities need to be obtained, if these communities are directly affected by a mining project (Minehutte 2019). Three main institutions -with different and defined roles- enforce the environmental regulations: The Ministry of Environment, the Environmental Assessment Service and the Environmental Superintendence. Moreover, according to Law No. 20.600, Environmental Courts have the power to resolve environmental disputes. EIS are presented to the responsible Regional Commission on the Environment or the Executive Directorate of the National Commission on the environment if several regions are affected (Minehutte 2019).
Areas of Law: Occupational Health and Safety (OHS)	Chile ratified the ILO Convention N° 161 Occupational Health Services Convention since 1999 (MDNP 2018). The Supreme Decree No. 132/2004 of the Ministry of Mining regulates occupational health and safety (OHS) measures in the mining sector with the objective to protect the life and physical integrity of all humans that work in or are related to the mining industry. It, furthermore, aims to protect facilities and infrastructure that allow mining operations and their continuance (MDNP 2018)(National Library of Congress 2017). In this framework, companies with more than 100 workers are required to have a Risk Prevention Department in place. This department is headed by an expert qualified by the National Geology and Mining Service

	(SERNAGEOMIN). The development of plans and programs for the prevention of accidents and occupational diseases is mandatory (MDNP 2018). In general, employers are obliged to ensure the safety of employees, machines and buildings (through training, protective clothing, maintenance of machines). At the same time, employees must ensure that occupational safety and safety rules are observed and controlled (ICLG 2018).

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?	Yes Yes (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?	Yes Yes (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?	Yes Yes (IRMA 2018)
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 2018a)
Responsible Mining Index Company indicator „Working conditions“	0.788 0.788 / 1.000 (RMI 2018a)
Responsible Mining Index Company indicator „Environmental sustainability“	0.668 0.668 / 1.000 (RMI 2018a)
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 (Collahuasi 2016)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes (Anglo American n.d.)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (OECD 2011)
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 No (EP n.d.)

*by companies own account.

Sources

Anglo American (n.d.): Registered and head office. https://www.angloamerican.com/sustainability/sustainability-contacts/contacts/registered-and-head-office. (13.06.2019).
Benton, D. (2018): Mitsui & Co to increase stake in world-class Collahuasi Copper Mine. https://www.miningglobal.com/mining-sites/mitsui-co-increase-stake-world-class-collahuasi-copper-mine. (13.06.2019).
Collahuasi (2016): sustainable Development Report 2015. Compañía Minera Doña Inés de Collahuasi. http://www.collahuasi.cl/wp-content/uploads/2016/05/REPORTE-COLLAHUASI-2015-EN.pdf (13.06.2019).

Collahuasi (2018): Site visit presentation. In: Compañía Minera Doña Inés de Collahuasi. https://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/presentations/2018pres/collahuasi-site-visit-presentation.pdf. (13.06.2019).
Collahuasi (n.d.): Our Company. In: Compañía Minera Doña Inés de Collahuasi. http://www.collahuasi.cl/en/quienes-somos/la-compania/. (13.06.2019.a).
Collahuasi (n.d.): Production and Sales. In: Compañía Minera Doña Inés de Collahuasi. http://www.collahuasi.cl/en/que-hacemos/produccion-y-ventas/. (13.06.2019.b).
Collahuasi (n.d.): Environmental. In: Compañía Minera Doña Inés de Collahuasi. http://www.collahuasi.cl/en/sustentabilidad/medio-ambiente/. (13.06.2019.c).
Consejo Minero (2019): Collahuasi. https://consejominero.cl/comunicaciones/plataforma-de-relaves/collahuasi/. (14.11.2019).
Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017a): Erörterung ökologischer Grenzen der Primärrohstoffgewinnung und Entwicklung einer Methode zur Bewertung der ökologischen Rohstoffverfügbarkeit zur Weiterentwicklung des Kritikalitätskonzeptes (ökoRess I) - Konzeptband. Umweltbundesamt, Dessau-Roßlau.
Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017b): Erörterung ökologischer Grenzen der Primärrohstoffgewinnung und Entwicklung einer Methode zur Bewertung der ökologischen Rohstoffverfügbarkeit zur Weiterentwicklung des Kritikalitätskonzeptes (ökoRess I) - Methode für einen standortbezogenen Ansatz. Umweltbundesamt, Dessau-Roßlau.
EI SourceBook (2016): Text of the Law No 19.300 General Bases for the Environment, published on the official gazette on 9th of March 1994. http://www.eisourcebook.org/cms/February%202016/Chile%20General%20Environment%20Law%201994.pdf. (28.12.2018).
EITI (2019): EITI Countries. In: Extractive Industries Transparency Initiative. https://eiti.org/countries. (16.04.2019).
EP (n.d.): EP Association Members & Reporting. In: Equator Principles. https://equator-principles.com/members-reporting/. (13.05.2019).
Eyzaguirre, N. (2018): Chile: Mining Law 2019. In: International Comparative Legal Guides International Business Reports. Text, https://iclg.com/practice-areas/mining-laws-and-regulations/chile. (10.09.2019).
Glencore (2017): Resources & Reserves Report 2017. https://www.glencore.com/dam/jcr:a2823ab5-5715-463d-83d2-a14ab0c0e8e3/GLEN-2017-Resources-Reserves-Report.pdf. (13.06.2019).
ICMM (2019): Member companies. In: International Council on Mining and Metals (ICMM). https://www.icmm.com/en-gb/members/member-companies. (16.04.2019).
ILO (2017): Ratifications of C176 - Safety and Health in Mines Convention, 1995 (No. 176). In: International Labour Organization (ILO). http://www.ilo.org/dyn/normlex/en/f?p=1000:11300:0::NO:11300:P11300_INSTRUMENT_ID:312321. (12.04.2018).

IRMA (2014): Standard for Responsible Mining. Draft v1.0. Initiative for Responsible Mining Assurance (IRMA). https://responsiblemining.net/wp-content/uploads/2018/09/IRMA_Standard_Draft_v1.007-14.pdf.
IRMA (2018): Responsible Mining Map. In: Initiative for Responsible Mining Assurance (IRMA). https://map.responsiblemining.net/. (16.04.2019).
MAC (2019): Our Members. In: The Mining Association of Canada (MAC). http://mining.ca/members-partners/our-members. (16.04.2019).
MDNP (2018): Country Fiche Chile. In: EU - Latin America Mineral Development Network Platform (MDNP). https://www.mineralplatform.eu/system/files/CountryFiche/MDNP_country-fiche_Chile_02.pdf. (19.09.2019).
Mindat (n.d.): Collahuasi Mine (Collaguasi Mine), Collahuasi district, El Tamarugal Province, Tarapacá, Chile. https://www.mindat.org/loc-39273.html. (13.06.2019).
Minehutte (2019): Chile - Mining & Environmental Law & Regulations. In: MineHutte - Regulatory Risk Ratings & Analysis of Global Mining Laws. https://minehutte.com/jurisdiction/chile/. (28.12.2018).
Mining Technology (n.d.): Collahuasi Copper Mine. In: Mining Technology | Mining News and Views Updated Daily. https://www.mining-technology.com/projects/collahuasi/. (13.06.2019).
OECD (2011): OECD Guidelines for Multinational Enterprises. OECD Publishing.
Pfister, S.; Koehler, A.; Hellweg, S. (2009): Assessing the Environmental Impacts of Freshwater Consumption in LCA. In: Environmental science & technology. Vol. 43, No.11, S. 4098–4104.
RMI (2018a): Anglo American - Company report. In: Responsible Mining Index (RMI). /en/companies/1. (13.06.2019).
RMI (2018b): Glencore - Company report. In: Responsible Mining Index (RMI). /en/companies/17. (13.06.2019).
UNEP (2019): Minamata Convention on Mercury: Parties and Signatories. In: UN Environment Programme (UNEP) - Minamata Convention on Mercury. http://www.mercuryconvention.org/Countries/Parties/tabid/3428/language/en-US/Default.aspx. (05.11.2019).
UNFCCC (2016): Paris Agreement Signatories Rise to 187. In: United Nations Framework Convention on Climate Change (UNFCCC). https://unfccc.int/news/malawi-armenia-zambia-and-chile-sign-paris-agreement. (23.07.2019).
Wendling, Z. A.; Emerson, J. W.; de Sherbinin, A.; Esty, D. C. (2020): 2020 Environmental Performance Index. Yale Center for Environmental Law & Policy, New Haven, CT. https://epi.yale.edu/epi-results/2020/component/epi (11.08.2020).
WGI (2019): The Worldwide Governance Indicators (WGI). The World Bank. http://info.worldbank.org/governance/WGI/#home. (10.12.2018).

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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