

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Sossego Copper Mine

Vale S.A., Brazil

ID: 71

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>

Sossego Copper Mine

Copper

General information



Indicator or criteria	Description and values
Name of mine	Sossego Copper Mine
Description of mining area	Sossego is a copper mine of the IOCG (iron oxide copper gold) in the metallogenetic province of Carajas. Controlled by shearing zones, the main ore bodies Sequeirinha and Sossego (as part of the mine site) are hosted in Precambrian granites, gabbros and metavolcanics (Shimizu 2012), Main ore mineral is chalcopyrite. Gold is an important by-product (Vale 2019a).
Surface extension	32.04km ² 32.04 km ² (Image date: 07.06.2017; Viewing height: 7.13 km) (Google Earth)
In operation since	2004 2004 (Vale 2019a)
Operator	Mineração Serra do Sossego S.A
Owner	Vale S.A.
Closest town	Canaã de Carajás, 25 km east of the mine
Province	State of Para
Country	Brazil
Longitude	-50.072621°
Latitude	-6.427031°
Altitude	235 m a.s.l. 235 m a.s.l. (Google Earth)
Main product and by-products	Main-product: copper (Cu); by-products: gold (Au)

On-site processing stages	Standard primary crushing and conveying, semi-autogenous milling in rotating drum, ore transformation in slurry, ball milling, copper concentrate flotation, tailings disposal, concentrate thickening, filtration (Vale 2019a).
Annual production	2018: 92 kt of copper (15.66 Mt tons of copper ore with 0.72 % copper); 59,000 troy ounces of gold (Vale 2019a)
Proven Reserves	103.1 Mt with 0.66 % Cu (Vale 2019a)
Probable Reserves	5.9 Mt with 0.69 % Cu (Vale 2019a)

Geology 				
Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	A scientific study reports acid drainage to a not known extend from Sossego Mine (Bernardes 2019).	In general 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	A number of other heavy metals (Cd, Cr, Ni, Pb) commonly associated with sulfide/ chalcopyrite deposits (Pereira 2014).	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 and uranium or other radioactive components could be determined. According to (De Ferran 2007 p. 99) the copper ore of the region shows no radioactivity.	In accordance with the measurement instructions (Dehoust et al. 2017b) copper ore deposits are evaluated with a medium EHP, if no further information is available.	Low	B1 = medium, can be estimated on the basis of available information

Deposit size	According to Vale the proven reserves amount to 103.1 Mt with 0.66 % Cu, the probable reserves to 5.9 Mt with 0.69% Cu, giving total reserves of 109.0 Mt with 0.66 % Cu (Vale 2019a).	Considering the total reserves of 109.0 Mt of Copper ore and adding the amount of copper ore extracted in the past (2004: 15 years - with an average of 12 Mt/year = 180 Mt) the total deposit size sums up to approximately 290 Mt. Assuming an average grade of 0.7 % Cu, the total Cu amounts to about 2.03 Mt. According to Petrow et al. (2008, In: Dehoust et al. 2017b) the complex is thus classified as medium size and evaluated with a medium EPH.	Medium	B1 = medium, can be estimated on the basis of available information
Ore grade	0.66 % Cu (Vale 2019a)	With 0.66 % ore grade in reserve and in accordance with the measurement instructions (Priester et al. 2019) the specific grade is classified as average grade with a medium EHP.	Medium	A = high, can be derived directly from available data

Technology 				
Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Open pit mining (Vale 2019a)	Mining is restricted to the horizontal and vertical extension of the ore body/mineralized zone; depleted pits are used for waste disposal. According to measurement instructions a medium EHP can be assigned.	Medium	B1 = medium, can be estimated on the basis of available information

Use of auxiliary substances	Mining by truck and shovel-loader; drilling and blasting. On site beneficiation plant in operation with standard primary crushing and conveying, semi-autogenous milling in rotating drum, ore transformation in slurry, ball milling, copper concentrate flotation, concentrate thickening, filtration steps (Vale 2019a).	This indicator is evaluated with a high EHP due to the use of potentially toxic substances in floating process.	High	B2 = medium, classified according to measurement instructions
Mining waste	Mostly fine mine tailings derived from flotation concentration of sulfidic copper ore are stored on site in a pond of 42 m Centerline dam height with a present volume of 108 Mm3 (ANM 2019).	According to ICOLD the Sossego Mine dam is a large dam 108Mm3. Due to the considerable volume of the tailings and the fine and ultrafine nature of the materials resulting from flotation a high EHP is assigned.	High	B2 = medium, classification according to measurement instructions
Remediation measures	Vale (2019b) reports water process recycling and treatment of tailing with copper eating bacteria. No specific information is available.	Process-parallel treatment of water used in the process is considered a remediation measure. No cultivation measures could be identified in satellite images nor in the available references. For this reason, a medium EHP is assigned.	Medium	B2 = medium, classification according to measurement instructions

Framework conditions natural environment



Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
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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). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	For the Sossego Mine there is a high EHP for flood events which determines the evaluation result. The EHP for the other sub-indicators is 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 water stress for the mining area is low and it 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 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

State Governance

Indicators	
WGI 1 -Voice and Accountability	61.58 ^{ooo}
WGI 2 -Political Stability and Absence of Violence/ Terrorism	31.43 ^{ooo}

WGI 3 - Government Effectiveness	41.83 ^{ooo}
WGI 4 -Regulatory Quality	51.44 ^{ooo}
WGI 5 - Rule of Law	43.75 ^{ooo}
WGI 6 -Control of Corruption	36.06 ^{ooo}
EPI (Environmental Performance Index)	60.7
EITI membership	No
International Agreements	
ILO 176	Brazil is part of ILO 176
Others	Reaffirmation of commitment with the 2030 Agenda for Sustainable Development in 2017 (Mercosur countries). Signature of the Paris Agreement on Climate Change and participation at COP 22. (MDNP 2018)
Legal framework	

<p>Areas of Law: Environment</p>	<p>Comprehensive legal framework on federal level with norms regarding licensing (compulsory for mining and industry), environmental impact assessment including the need for public consultations during the primary licence process and Environmental management and mine closure plan in the course the installation licence (MineHutte 2019), environmental crimes, waste management, water and groundwater protection, contaminated land exist (Leonhardt / Stump 2018). Federal states have legislation and regulation autonomy, however (with exception of some states in the industrialized southeast) limited enforcement capacity (ibid.). "Polluter pays" and joint liability are basic principles regarding recovery/mitigation of impacts. The public prosecutor being represented by the independent public ministry (Ministerio Publico) on federal and state level has controlling function also over environmental authorities (ibid.). Environmental and mining authorities still need to align licensing procedures. Sector Plans for Mitigation and Adaptation to Climate Change in Mining aims at the reduction of CO2 in the mining sector (MDNP 2018).</p>
<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>Brazil implements the National Norm NR-22 since 1999 through its Ministry of Labour. The norm specifies the conditions for safe working and health conditions in mining, in accordance to ILO 176 criteria and is also responsible for the inspections of compliance with occupational health and safety (OHS) regulations (Cattabriga / Castro 2014). Companies inform all accidents to the INSS, an agency of the Ministry of Social Welfare (MPAS), which administers a compulsory employer-funded compensation insurance system (Elgstrand et al. 2013). The National Department for Mineral Production – DNPM published the Mining Regulatory Standard in 2001, which supports the establishment of specific sectorial and state standards of OHS in Mining (DNPM 2001) .</p>

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)?	Yes Yes (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 yet applicable
Responsible Copper (RC): Is the mine certified?	Not applicable Not yet applicable
Responsible Mining Index (RMI): Has the mine been rated?	No No (RMI 2018)
Responsible Mining Index Company indicator „Working conditions“	0.575 0.575 (RMI 2018)

Responsible Mining Index Company indicator „Environmental sustainability“	0.391 0.391 (RMI 2018)
Responsible Steel (RS): Is the mine owner a member of the RS?	No information obtained No information obtained
Responsible Steel (RS): Is the mine certified?	No information obtained No information obtained
Australian Steel Stewardship Forum (ASSF): Is the owner a member of the ASSF?	No No (ASSF 2019)
Australian Steel Stewardship Forum: Is the mine certified?	No No (ASSF 2019)
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (Vale 2019a)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (RMI 2018)
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 No
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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- Öko-Institut e.V. (Institute for Applied Ecology)