ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Minas Centrais Complex

Vale S.A., Brazil

ID: 9

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

Minas Centrais Complex

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Minas Centrais Complex
Description of mining area	According to Vale (Vale 2009) Minas Centrais' integrated operations is represented by Brucutu mine operation and by Apolo deposit, not currently in production. Agua Limpa and Congo Soco Mine are no longer operating and therefore is not included in the disclosure anymore. . The mine sites are located in the northeastern border of the Iron Quadrangle of Minas Gerais and consist mainly of banded iron formation. Geographically, Andrade mine also forms part of the complex but is owned by ArcelorMittal and therefore is outside the scope of the joint assessment (Vale 2018).
Surface extension	33.16km^2 33.16 km^2 (Image date: 10.09.2018; Viewing height: 5.10 km) (Google Earth)
In operation since	2000 2000
Operator	Vale S.A.
Owner	Vale S.A.
Closest town	Brucutu Mine: 5 km south of São Gonçalo de Rio Baixo; Andrade Mine: 18 East-Northeast of São Gonçalo de Rio Baixo; Gongo Soco Mine: 12 km west of Barão de Cocais; Agua Limpa Mine: 5 km west of Rio Piracicaba.
Province	State of Minas Gerais
Country	Brazil
Longitude	-43.382181°
Latitude	-19.860436°
Altitude	1000 m a.s.l. About 1000 m a.s.l. (Brucutu Mine)

Main product and by-products	Iron ore
On-site processing stages	Standard crushing, classification, grinding and concentration steps (floatation, magnetic separation) to produce sinter feed, lump ore and pellet feed in 2 major and one secondary beneficiation plants located at the mining complex; transport to smelters off-site (MDO 2018).
Annual production	Minas Centrais (Brocutu Mine) 2017: 37.6 Mt (Vale 2018).
Proven Reserves	149.9 Mt with 48.5 % of Fe (Vale 2018)
Probable Reserves	626.7 Mt with 56.6 % ore grade (Vale 2018)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The MCC comprises oxidic iron ore minerals such as hematite, itaberite and lateritic ore. No sulphides are reported. Limited geochemical preconditions for acid mine drainage are given.	Iron is a siderophilic element, therefore no preconditions for acid mine drainage for this ore type. According to the site-related Oekoress measurement instructions, siderophilic ore deposits are classified with a medium environmental hazard potential (EPH).	Medium	A = high, can be derived directly from available data
Paragenesis with heavy metals	No heavy metal paragenesis is reported from Mariana. According to Wellmer and Hageluecken (2015) heavy metals and arsenic may have e limited relevance the extraction oxidic ron ores.	According to the measurement instructions, heavy metals like lead, zinc, copper, chrome and arsenic may potentially be associated to oxidic iron ores. The EHP is thus classified as medium.	Medium	B1 = medium, can be estimated on the basis of available information

Paragenesis with radioactive components	No indication of paragenesis with thorium and uranium could be determined.	In accordance with the measurement instructions, iron ore deposits are evaluated with a medium EHP, if no further information is available. This class division is based on average thorium and uranium activity levels in Chinese iron ore deposits (Hua 2011; USGS 2015).	Medium	B1 = medium, can be estimated on the basis of available information
Deposit size	According to annual report (Vale 2018) in 2017 proven ore reserves amount to 149.9 Mt with 48.5 % of Fe and probable reserves amount to 626.7 Mt with 56.6 % ore grade, totalling 776.6 Mt; (Brucutu Mine and Apolo deposit).	Considering the total reserves of about 776.5 Mt and adding the already extracted amount of iron ore extracted in the past (Brucutu Mine since 2006 - 12 years- with an average of 30 Mt/year = 360 Mt; Agua Limpa (2000-2013): about 63 Mt, operation stopped and Congo Soco (2000-2013): 96.6.2 Mt, depleted), the total deposit size sums up to slightly more than 1300 Mt (Vale 2006). Assuming an average grade of 50 % Fe the total Fe amounts to about 650 Mt . 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	55.1 % (Vale 2018)	With 55.1 % medium ore grade 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	Mining is restricted to the horizontal and vertical extension of the ore body/mineralized zone; depleted pits are used for waste disposal.	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. 2 processing plants are in operation, where processing standard procedures are carried out: crushing, classification, grinding and concentration steps (floatation with organic compounds like either amines utilised as collectors and starch as depressants according to G.M. Lopes (2009) and magnetic separation.	Evaluated with a high EPH due to the use of toxic substances like ether amines, which are common in flotation.	High	B2 = medium, classified according to measurement instructions
Mining waste	Brucutu: Since the southern tailing ponds have reached their capacity, a new tailing pond system of considerable superficial extension (up to 5 km2) is being operated since 2013 (IEF 2013) with an estimated (licensed) volume of 55 million m3 and 3 waste piles licensed.	According to ICOLD (2018) the new Brucutu tailing pond, with a volume of 55 million m3, is considered a large dam (>than 3 million cubic metres); thus, together with the southern dam (no information available regarding dam height and volume) the indicator is classified with a high EHP.	High	B1 = medium, can be estimated on the basis of available information
Remediation measures	Brucutu: Compensation measures such as reforestation, environmental monitoring and	Remediation measures are established by the environmental regulating	Medium	B2 = medium, classified

	control are established by the Ministry of the Environment of Minas Gerais (Companhia Vale do Rio Doce 2004). Gongo Soco and Agua Limpa Mines: Depleted and in process of stabilization (ibid.) but no further information on remediation measures in progress obtained.	authority of Minas Gerais State but no information on implementation available. No rehabilitation measures visually evident for depleted mines in image analyses (GoogleEarth 2018).		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). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	The environmental hazard potential (EHP) for landslides high The EHP is negligible for other aspects: earthquakes, tropical storms, floods and the arctic environment.	High	k.A.
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.	EHP for the WSI is low and the mine is not situated in a desert area.	Low	k.A.
Protected areas and AZE sites	Georeferenced data for designated protected areas are used to assess hazards posed by mining extraction. The metric to evaluate	There is a medium EHP for protected areas and AZE sites.	Medium	k.A.

	EHPs corresponds to the method first described in the draft standard of the Initiative for Responsible Mining Assurance (IRMA 2014).			

State Governance

Indicators	
WGI 1 -Voice and Accountability	61.58 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	31.43 °°°
WGI 3 - Government Effectiveness	41.83 °°°
WGI 4 -Regulatory Quality	51.44 °°°
WGI 5 - Rule of Law	43.75 °°°
WGI 6 -Control of Corruption	36.06 °°°
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	
Areas of Law: Environment	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).

Areas of Law: Occupational Health and Safety (OHS)	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) .

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 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“	0.575 0.575 / 1.000 (RMI 2018)
Responsible Mining Index Company indicator „Environmental sustainability“	0.391 0.391 / 1.000 (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 2017)

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 (Brazil) (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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