ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Itabira Iron Ore Complex

Vale S.A., Brazil

ID: 11

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

Itabira Iron Ore Complex

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Itabira Iron Ore Complex
Description of mining area	According to Vale, Itabira integrated operation includes Conceição and Minas do Meio mines, and later also called Caue Mine. The mine sites which belong to Vale´s south-eastern System are located in the very north-eastern border of the Iron Quadrangle of Minas Gerais, and consist mainly of banded iron formation. The mines are operational since 1957 (Vale 2019).
Surface extension	60.42km^2 60.42 km2 (Image date: 03.09.2019; Viewing height: 13.72 km) (Google Earth)
In operation since	1957 1957 (Vale 2019)
Operator	Vale S.A.
Owner	Vale S.A.
Closest town	Itabira, 100 m east of the complex
Province	State of Minas Gerais
Country	Brazil
Longitude	-43.15072°
Latitude	-19.37549°
Altitude	1000 m a.s.l. Between 800 and 1000 m a.s.l.
Main product and by-products	Main-product: iron ore; by-products: none

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 2019).
Annual production	2018: 41.7 Mt (Vale 2019)
Proven Reserves	678.5 Mt with 45.7 % of Fe (Vale 2019)
Probable Reserves	173.9 Mt with 45.8 % ore grade (Vale 2019)

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 are given. According to the site-related Oekoress measurement instructions (Dehoust et al. 2017b), siderophilic ore deposits are classified with a medium environmental hazard potential (EHP).	Medium	A = high, can be derived directly from available data
Paragenesis with heavy metals	No indication of heavy metal paragenesis could be determined from Itabira Complex. According to Wellmer and Hageluecken (2015)heavy metals and arsenic may have e limited relevance in the extraction of oxidic iron ores.	According to the measurement instructions (Dehoust et al. 2017b), 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 or other radioactive components could be determined.	In accordance with the measurement instructions (Dehoust et al. 2017b) 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 2019) in 2018 proven ore reserves amount to 678.5 Mt with 45.7 % of Fe and probable reserves amount to 173.9 Mt with 45.8 % ore grade, totalling 861.4 Mt.	Considering the total reserves of 861.4 Mt and adding the amount of iron ore extracted in the past (1957: 61 years - with an average of 30 Mt/year = 1830 Mt) the total deposit size sums up to more than 2600 Mt Assuming an average grade of 45 % Fe, the total Fe amounts to about 1170 Mt . According to Petrow et al. in Dehoust et al., (2017) the complex is thus classified as large size and evaluated with a high EPH.	High	B1 = medium, can be estimated on the basis of available information
Ore grade	45.7 % (Vale 2019)	With 45.7 % 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 (Vale 2019).	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. 3 major beneficiation plants are in operation (Vale 2019), where processing standard procedures are carried out: crushing, classification, grinding, concentration and magnetic separation. Concentration steps such as floatation with organic compounds like ether amines as collectors and starch depressants are utilised according to G.M. Lopes (2009).	This indicator is evaluated with a high EHP due to the use of potentially toxic substances.	High	B2 = medium, classified according to measurement instructions
Mining waste	A total of 15 tailing ponds and dams are reported Itabira Complex. Amongst the dams belonging to this Complex are the Pontal e Itabiruçu dams, which are among the largest dams in Brazil with capacities of 227 and 130 million m3. However, these two do not use upstream dam technology (Barifouse 2019).	According to ICOLD (2018) the Pontal and Iburuçu ponds are considered large dams (>than 3 million cubic metres); thus the indicator is classified with a high EHP.	High	B1 = medium, can be estimated on the basis of available information
Remediation measures	Vale is defendant in two separate actions where the municipality of Itabira alleges that the mining operations have caused environmental degradation, claiming immediate restoration of the affected ecological complex. The claims of the municipality of Itabira against Vale, which in only one action amount to approximately	Vale´s upstream dams are going to be decommissioned (drainage, removal of waste, restoration of an appropriate topography and of the soil, reforestation) in the next 3 years. The Itabira dams although not part of the upstream dam group with their enormous capacity and potential	High	B2 = medium, classified according to measurement instructions

	R$6.7 billion (1.67 billion US$) are still on course or suspended until presentation of expert report (Vale 2019).	environmental impact represent a continuous threat to the surroundings which is reflected in the two action running against Vale (Alvarenga 2019). The ongoing conflicts and still missing solutions for environmental restauration justify the assignment of a high EHP.		

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.	For the Itabira Iron Ore Complex there is a medium EHP for landslides which determines the evaluation result. The EHP for the other sub-indicators is low.	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 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 °°°
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 (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 n.d.)
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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