ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Casa de Pedra

CSN, Brazil

ID: 22

German Environment Agency

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

Casa de Pedra

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Casa de Pedra
Description of mining area	The Casa de Pedra mine is located near the southwestern corner of the Iron Quadrangle (Quadrilátero Ferrífero). Ores include hematite and supergene deposits. The ore at Casa de Pedra is low in sulphur and phosphorous. It is hosted in the Itabira Group strata of the largely Paleoproterozoic Minas Supergroup (MinDat 2017).
Surface extension	33.26km² 33.26 km² (Image date: 23.12.2018; Viewing height: 9.22 km) (Google Earth)
In operation since	1913 1913 (CSN 2018 p. 39)
Operator	CSN
Owner	CSN
Closest town	7 km west of the town of Congonhas
Province	State of Minas Gerais
Country	Brazil
Longitude	-43.919596°
Latitude	-20.480054°
Altitude	1165 m a.s.l. 1165 m a.s.l. (Google Earth)
Main product and by-products	Main product: Iron ore; no by-products (CSN 2018)

On-site processing stages	Standard crushing, classification, grinding and concentration steps (floatation, magnetic separation) to produce sinter feed, lump ore and pellet feed in a Central on site and one offsite (Pires) beneficiation plants (CSN 2018)
Annual production	26.05 Mt (CSN 2018 p. 41)
Proven Reserves	1,043 Mt with 41.36 % of Fe (CSN 2018 p. 40)
Probable Reserves	1,662 Mt with 41.36 % ore grade (CSN 2018 p. 40)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The Casa de Pedra Mine comprises oxidic iron ore minerals such as hematitic ore (7 %) and itaberite (93 %) (CSN 2018 p. 40) . 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 is given. According to the site-related Oekoress measurement instructions (Dehoust et al. 2017b), 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 could be determined from Casa de Pedra Iron Ore Mine. According to (Wellmer / Hagelüken 2015)heavy metals and arsenic may have limited relevance for 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 were determined.	In accordance with the measurement instructions (Dehoust et al. 2017b), iron ore deposits are evaluated with a low EHP, if no further information is available..	Medium	B1 = medium, can be estimated on the basis of available information
Deposit size	According to annual report (CSN 2018 p. 40) in 2017 proven ore reserves amount to 1,043 Mt with 41.36% of Fe and probable reserves amount to 1,662 Mt with 41.36% ore grade, totaling 2,705 Mt with 41.36% Fe.	Considering the total reserves of about 2,705 Mt and adding the already amount of iron ore extracted in the past (the Complex is in operation since 1913 = 105 years- with an average of 10 Mt/year = 1,050Mt; the total deposit size sums up to approximately 3,855 Mt. Assuming an average grade of 41 % Fe the total Fe amounts to about 1,542 Mt. According to the measuring instructions, the complex is thus classified as large size and evaluated with a high EPH.	High	A = high, can be derived directly from available data
Ore grade	41.36% (CSN 2018 p. 40)	With 41.36 % average ore grade of total and proven reserves, the specific ore grade is classified as average grade in accordance with the measurement instructions (Priester et al. 2019). Thus, a medium EHP can be assigned.	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 (CSN 2018 p. 39)	Mining is restricted to the horizontal and vertical extension of the ore body/mineralized zone; depleted pits and large peripherical areas are used for waste disposal. According to measurement instructions (Dehoust et al. 2017b) a Medium EHP can be assigned.	Medium	B1 = medium, can be estimated on the basis of available information
Use of auxiliary substances	According to Securities and Exchange Comm U.S.A. 2018 (CSN 2018 p. 37), ore is extracted by hydraulic shovels and wheel loaders including drilling and blasting. Crushing, screening and concentration take place at Casa de Pedra mine´s Central beneficiation plant and Pires beneficiation plant (latter not part of the mine). Concentration steps such as floatation with organic compounds like ether amines as collectors and starch depressants are usually utilised in iron ore beneficiation, according to (Lopes 2009), electric power supply comes from hydroelectric energy sources.	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	The bulk of mine tailings are stored in Casa de Pedra main tailing pond next to the urban zone of Congonhas, having downstream dam	According to ICOLD (2018) the dam is a large dam with 84 m of height and 27.71 Mm3 of present volume. Additionally	High	A = high, can be derived directly

	technology. According to (ANM 2019) the dam has a height of 84 m and a capacity of 50 Mm3 being 27.71 Mm3 the present volume. Other much smaller dams are to be found at the circumference of the mine; however, no further information is available.	close proximity(<400m) to the settlement area of Congonhas, justifies that the indicator for the mine is classified with a high EHP according to the measuring instructions of (Dehoust et al. 2017b).		from available data
Remediation measures	Since the Feijao Mine dam collapse emergency actions, safeguarding and remediation measures target the mitigation of the disastrous effects of the liberation of mine tailings and the safety of human lives rather than environmental remediation of the existing mine sites. To diminish the waste volume at the site, high intensity magnetic concentrators are to recover a maximum of 20 % of material from waste piles. The smaller dams (B4 and B5) are in the process of decommissioning and dam maintenance is being assured (Minerios Minerales 2018). Financial accruals for rehabilitation of up to R$369 million (about 100 million US$) were assigned in 2016.	Although remediation of environmental liabilities due to prior operations, especially before privatization, is reported by CSN (CSN 2018 p. 54), no further description of individual measures besides the measures mentioned in the preceding (left) box is available. Recommendations of public prosecutor to resettle the population near the dam and mines site show lack of trust and confidence in the remediation and safeguarding measures and its compliance with legislation. Because of ongoing measures in respect to waste minimization and management, dam maintenance and financial accruals, a medium EHP is assigned.	Medium	B2 = medium, classified 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.	With high flood hazard and medium land-slide hazard, a high composite Accident hazard is assigned.	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 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 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	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?	No No (ICMM 2019)
Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?	No No (IRMA 2018)
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“	Not applicable Not applicable

Responsible Mining Index Company indicator „Environmental sustainability“	Not applicable Not applicable
Responsible Steel (RS): Is the mine owner a member of the RS?	No No (Responsible Steel 2019)
Responsible Steel (RS): Is the mine certified?	No No (Responsible Steel 2019)
Australian Steel Stewardship Forum (ASSF): Is the owner a member of the ASSF?	No No (ASSF 2018)
Australian Steel Stewardship Forum: Is the mine certified?	No No (ASSF 2018)
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (CSN 2018 p. 53)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (CSN 2019)
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.

Sources

ANM (2019): Cadastro Nacional de Barragens de Mineração. In: Agência Nacional de Mineração (ANM). http://www.anm.gov.br/assuntos/barragens/pasta-cadastro-nacional-de-barragens-de-mineracao/cadastro-nacional-de-barragens-de-mineracao. (29.07.2019).

ASSF (2018): ASSF Membership. In: Australian Steel Stewardship Forum. http://steelstewardship.com/membership/. (13.05.2019).

Cattabriga, L.; Castro, N. F. (2014): Saúde e segurança no trabalho. In: Tecnologia de rochas Ornamentais. CETEM/MCTI, Rio de Janeiro.

CSN (2018): Form 20-F. Companhia Siderúrgica Nacional (CSN). http://ri.csn.com.br/publicacoes-cvm-sec/20-f/ (22.10.2019).

CSN (2019): Companhia Siderúrgica Nacional (CSN). http://www.csn.com.br/default_eni.asp?idioma=1&conta=46. (11.02.2020).

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.

DNPM (2001): Portaria No 237, de 18 de Outubro 2001. Departamento Nacional de Produção Mineral (DNPM). http://www.dnpm.gov.br/acesso-a-informacao/legislacao/portarias-do-diretor-geral-do-dnpm/portarias-do-diretor-geral/portaria-no-237-em-18-10-2001-do-diretor-geral-do-dnpm (13.05.2019).

EITI (2019): EITI Countries. In: Extractive Industries Transparency Initiative. https://eiti.org/countries. (16.04.2019).

Elgstrand, K.; Vingård, E. (2013): Occupational safety and health in mining: anthology on the situation in 16 mining countries. Occupational and Environmental Medicine, University of Gothenburg, Göteborg.

ICMM (2019): Member companies. In: International Council on Mining and Metals (ICMM). https://www.icmm.com/en-gb/members/member-companies. (16.04.2019).

ICOLD (2018): World Register of Dams - General Synthesis. In: International Commission on Large Dams (ICOLD). https://www.icold-cigb.org/GB/World_register/general_synthesis.asp. (12.06.2019).
ILO (2017): Ratifications for Brazil. In: International Labour Organization (ILO). https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:102571. (13.05.2019).
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).
Leonhardt, R. D.; Stump, D. (2018): Brazil: Environment and Climate Change Law 2019. In: International Comparative Legal Guides. https://iclg.com/practice-areas/environment-and-climate-change-laws-and-regulations/brazil. (13.05.2019).
Lopes, G. M. (2009): Flotação direta de minério de ferro. Escola de Minas da Universidade Federal de Ouro Preto, Ouro Preto.
MDNP (2018): Country Fiche Brazil. In: EU - Latin America Mineral Development Network Platform (MDNP). https://www.mineralplatform.eu/system/files/CountryFiche/MDNP_country-fiche_Brazil_02.pdf. (19.09.2019).
MinDat (2017): Casa de Pedra mine, Congonhas, Minas Gerais, Brazil. https://www.mindat.org/loc-217906.html. (22.10.2019).
MineHutte (2019): Brazil - Mining & Environmental Law & Regulations. In: MineHutte - Regulatory Risk Ratings & Analysis of Global Mining Laws. https://minehutte.com/jurisdiction/brazil/. (13.05.2019).
Minerios Minerales (2018): Mina Casa de Pedra está há 105 anos em operação | Revista Minérios.
OECD (2019): Member Countries. In: Organisation for Economic Co-operation and Development (OECD). https://www.oecd.org/about/members-and-partners/. (05.11.2019).
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.
Priester, M.; Ericsson, M.; Dolega, P.; Löf, O. (2019): Mineral Grades: An important indicator for environmental impact of mineral exploitation. In: Mineral Economics. Raw Materials Report. Springer Nature Vol. 32, No.2, S. 127–256.
Responsible Steel (2019): Members and Associates. https://www.responsiblesteel.org/membership/members-and-associates/. (07.01.2019).
RMI (2018): Companies. In: Responsible Mining Index (RMI). /en/companies/29. (16.04.2019).
Vale (2019): Relatório 20-F. http://www.vale.com/brasil/pt/investors/information-market/annual-reports/20f/paginas/default.aspx (23.10.2019).
Wellmer, F.-W.; Hagelüken, C. (2015): The Feedback Control Cycle of Mineral Supply, Increase of Raw Material Efficiency, and Sustainable Development. In: Minerals. Vol. 5, No.4, S. 815–836.

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

Publisher:

German Environment Agency

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Project period: 03/2018 –02/2021

The research project has been commissioned by the German Environment Agency as part of the Environmental Research Plan of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and funded by the Federal Government (FKZ: 3717 35 306 0).

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