ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Miraí Bauxite Mine

Companhia Brasileira de Aluminio (CBA), Brazil

ID: 96

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

Miraí Bauxite Mine

Bauxite

General information

Indicator or criteria	Description and values
Name of mine	Miraí Bauxite Mine
Description of mining area	The bauxites of Mirai are part of the bauxite belt of Zona da Mata in the State of Minas Gerais. They are derived from weathering of charnockite and granulitic paragneiss of the Paleoproterozoic Juiz de Fora complex. With generally little lateral extension on hilltops, the bauxite deposits reach a thickness of up to 10 m. They mainly consist of gibbsite, goethite and hematite (Libera Fonseca 2017 p. 12). The Mirai bauxites include several smaller pits the most important of which are the pits in the vicinity of Mirai such as Sto. Antonio and Fazenda Sobrasil. The Itamarati de Minas mine (not considered in this Fact Sheet with exemption for "deposit size") started production in 1992 (CBA 2019a) and since 2015 is out of operation (Abal 2017; Libera Fonseca 2017).
Surface extension	27.4km² 27.40 km² (No area data can be derived from satellite images. Area assumption, based on internal statistics)
In operation since	2008 2008 (CBA 2019b p. 17)
Operator	Companhia Brasileira de Aluminio (CBA)
Owner	Companhia Brasileira de Aluminio (CBA)
Closest town	37 km NNE of the town of Cataguases (Google Earth)
Province	State of Minas Gerais
Country	Brazil
Longitude	-42.564935°

Latitude	-21.062492°
Altitude	800 m a.s.l. 650-800 m a.s.l. (Google Earth)
Main product and by-products	Main product: bauxite; no by-products
On-site processing stages	Strip-mining, and processing steps such as crushing and grinding, washing and sorting (Abal 2017)
Annual production	2016: 1.794 Mt (Libera Fonseca 2017 p. 9)
Proven Reserves	No information available
Probable Reserves	No information available

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Bauxite is a supergene enrichment of Al forming oxidic ore deposits. Aluminium (Al), which is extracted from bauxite, is a lithophilic element and primarily occurs in the form of gibbsite, which is a stable mineral under weathering conditions. It is, thus, stable under exposure to weathering in tailing ponds and waste piles. In general, AMD requires the presence of sulphide minerals.	As Al is a lithophile element and bauxite forms oxidic ore deposits, according to the measurement instructions bauxite mining and beneficiation imply in low environmental hazard potential for AMD (Dehoust et al. 2017b).	Low	B2 = medium, classified according to measurement instructions
Paragenesis with heavy metals	No paragenesis with heavy metals is reported from Mirai. Heavy metals and arsenic may have limited relevance the	According to the measuring instructions (Dehoust et al. 2017b), aluminium may be associated with	Medium	B2 = medium, classified according to measurement instructions

	extraction of oxidic Al-ores like bauxites (Wellmer / Hagelüken 2015).	zinc, copper and chrome. Hence, the EHP is classified as medium		
Paragenesis with radioactive components	No indication of paragenesis with thorium and uranium could be found.	In accordance with the measuring instructions, bauxite 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	The total reserves of the Itamarati de Minas Mine which corresponds more or less to the Mirai Mine was estimated to 206.3 Mt in 2009 (Quaresma 2009 p. 8). No more recent data were found.	Due to lack of reliable data on reserves we take into account 16 years of production of Itamarati /Mirai Mine (1992-2018) (CBA 2019a) with an average production of 1.8 Mt/a of bauxite, resulting in 28.8 Mt. Adding the above-mentioned reserves of 206,3 Mt, the deposit size is between 226 and 234 Mt, with a mean of 230 Mt. With 31 % of Al2O3, the deposit contains 71 Mt of Al2O3 and thus is considered a medium sized (10 -100 Mt) deposit, assigning a medium EHP.	Medium	B1 = medium, can be estimated on the basis of available information
Ore grade	31.3 % Al2O3 (Quaresma 2009 p. 8)	Considering other top bauxite deposits, Mirai with an average grade of 31.3 % can be considered a low-grade ore deposit with reference to undisclosed data. A high EHP is assigned.	High	B1 = medium, can be estimated on the basis of available information

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Open pit mining	The superficial excavation of the weathered bauxite horizon results in surface consumption. However, in the case of Mirai bauxites, the interventions of the surface are less significant due to the limited lateral extension of the mostly deep bauxite deposits restricted to hilltops. For this reason, they are evaluated with a medium EHP.	Medium	B1 = medium, can be estimated on the basis of available information
Use of auxiliary substances	The extraction is done by strip mining, No specific information on the use of auxiliary substances is available. The processing on-site includes crushing and grinding, washing and sorting, followed by water flushing (CBA 2018).	No auxiliary substances with the exception of water are used for ore processing. Although no information regarding blasting is available, blasting especially in deep consolidated bauxite profiles is probable and may justify the assignment of a low EHP following the criteria of (Dehoust et al. 2017b).	Low	B2 = medium, classified according to measurement instructions
Mining waste	The bulk of mine tailings are stored in Mirai Mine tailing pond, having downstream dam technology. According to (ANM 2019) the dam has a height of 52 m and a capacity of 56 Mm3 being 31.6 Mm3 the present tailings volume.	According to ICOLD (2018) the dam is a large dam with52 m of height and 31.6 Mm3 of present volume. Which justifies that the indicator for the mine is classified with a high EHP according to the measuring instructions of (Dehoust et al. 2017b).	High	A = high, can be derived directly from available data

Remediation measures	Restoration of stripping sites to productive agricultural land is ongoing with an average of restored area between 20 and 30 ha/a (CBA 2019 p.36).	Process-parallel renaturation of the mining areas, integrated systems of water consumption reduction and environmental impact monitoring are implemented (CBA 2019 p.48). For this reason and the visible evidence in Google Earth (imagery date 4/30/2018) showing few and little open and reworked surfaces (less than 2 km2) justify a low EHP.	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, 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 EHP for all sub-indicators (earthquakes, flood, landslide, tropical storm, arctic region) is low for all three pits of the mining area.	Low	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 all 3 pits of Mirai is low and the sites are 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).	None of the three mining sites are 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?	Yes Yes (ASI 2019; CBA 2019b)
Aluminium Stewardship Initiative (ASI): Is the mine certified?	No No (ASI 2019)
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 (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“	No No (RMI 2018)

Responsible Mining Index Company indicator „Environmental sustainability“	No No (RMI 2018)
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 (CBA 2018)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (Brazil) (CBA 2019c)
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

Abal (2017): BAUXITE IN BRAZIL RESPONSIBLE MINING AND COMPETITIVENESS. http://abal.org.br/downloads/publicacoes/bauxita-no-Brasil-mineracao-responsavel-e-competitividade-eng.pdf (09.03.2019).

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).

ASI (2019): Certifications Map. https://www.google.com/maps/d/embed?mid=1Jj7wrlnhunVOAjQMhi3lEN9JYoq2s2yi&ll=-3.086119323230049%2C-10.907751172616372&z=2. (26.08.2019).

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

CBA (2018): panorama bauxita brasil - Pesquisa Google.

CBA (2019a): Nossa Trajetória. In: Companhia Brasileira de Alumínio (CBA). https://www.aluminiocba.com.br/cba/nossa-trajetoria/. (24.10.2019).

CBA (2019b): CBA | Relatório Anual 2018 | Resultados de Sustentabilidade. http://cba.com.br/RelatorioAnual2018 (11.10.2019).

CBA (2019c): Where we are. In: Companhia Brasileira de Alumínio (CBA). https://www.cba.com.br/en/cba/onde-estamos/. (12.02.2020).

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.
Hua, L. (2011): The Situation of NORM in Non-Uranium Mining in China. China National Nuclear safety Administration. http://www.icrp.org/docs/Liu%20Hua%20NORM%20in%20Non-Uranium%20Mining%20in%20China.pdf (22.01.2016).
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).
Libera Fonseca (2017): Alumínio – Recursos Minerais de Minas Gerais. CODEMGE.
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 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).
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).
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.
Quaresma, L. F. (2009): Contrato No 48000.003155/2007-17: Desenvolvimento de estudos para elaboração do plano duodecenal (2010 - 2030) de geologia, mineração e transformação mineral. J. Mendo Consultoria.

http://www.mme.gov.br/documents/1138775/1256650/P11_RT22_Perfil_da_Mineraxo_de_Bauxita.pdf/1713eb90-cbf9-42e5-a502-18abf47d9a1f (24.10.2019).
RMI (2018): Companies. In: Responsible Mining Index (RMI). /en/companies/29. (16.04.2019).
USGS (2015): Mineral Commodity Summaries 2015. U S Geological Survey, Washington.
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

Section III 2.2

PO Box 14 06

06813 Dessau-Rosslau, Germany

Tel: +49 340-2103-0

info@umweltbundesamt.de

www.umweltbundesamt.de

Contact:

Jan Kosmol – jan.kosmol@uba.de

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).

Contractor:

Projekt-Consult GmbH

Eulenkrugstrasse 82

22359 Hamburg, Germany

T +49 (40) 60306-740

F +49 (40) 60306-199

www.projekt-consult.de

Contact:

Dr. Aissa Rechlin – aissa.rechlin@projekt-consult.de

Christopher Demel – christopher.demel@projekt-consult.de

Project Partners:

- ifeu – Institut für Energie-und Umweltforschung Heidelberg gGmbH (Institute for Energy and Environmental Research)
- Öko-Institut e.V. (Institute for Applied Ecology)