

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Trombetas Bauxite Mine

Vale S.A., Brazil

ID: 80

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>

Trombetas Bauxite Mine

Bauxite

General information	
Indicator or criteria	Description and values
Name of mine	Trombetas Bauxite Mine
Description of mining area	Trombetas system consist of a number of mines with Saracá, Bela Cruz and Monte Branco mines in operation (MRN 2018a). The ore lies at an average depth of 8 meters and is covered with dense vegetation and a layer of overburden made up by organic soil, clay, nodular bauxite and ferruginous laterite. Bauxites are associated with plateaus, high areas with relatively plan ridges and elevations between 200 and 160 meters, which were formed from lateritization of Al-rich sedimentary rocks (MDO 2018).
Surface extension	92.7km ² 92.70 km ² (Image date: 11.07.2015; Viewing height: 5.73 km) (Google Earth)
In operation since	1979 1979
Operator	Mineração Rio do Norte
Owner	Vale S.A.
Closest town	Town of Oriximinã, 63 km SW
Province	Pará
Country	Brazil
Longitude	-57.976389°
Latitude	-1.742222°
Altitude	180 m a.s.l. 180 m (Saracá Mine)
Main product and by-products	Bauxite



On-site processing stages	Open pit mining. The ore is transported by trucks to primary crushers and by conveyor belt to the beneficiation plant (classification by grain size, cyclone and filtering) (MDO 2018).
Annual production	2017: 16.28 Mt bauxite (MRN 2017) 2015: 24.27 Mt run-of-mine (ROM) (AHK Brasilien 2016)
Proven Reserves	34 Mt Al ₂ O ₃ 49.9 % (MDO 2018)
Probable Reserves	15 Mt Al ₂ O ₃ 50.5 % (MDO 2018)

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, 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.	Bauxite mining and beneficiation represents no condition for AMD and thus a low environmental hazard potential (EHP).	Low	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	No paragenesis with heavy metals is reported in Trombetas. Heavy metals and arsenic may have limited relevance the extraction of oxidic Al-ores like bauxites. (Wellmer / Hagelüken 2015).	According to the measurement instructions, aluminium may be associated with zinc, copper and chrome. Hence, the EHP is classified as medium.	Medium	B2 = medium, classified according to measurement instructions

Paragenesis with radioactive components	No indication of paragenesis with thorium and uranium could be determined.	Bauxites formed by lateritic weathering of silicate rocks (among others granite, gneiss, clay) are evaluated with a medium EHP, if no further information indicates otherwise. This class division is based on average thorium and uranium activity levels in Chinese bauxite deposits (Hua 2011; USGS 2015). For comparison: Carbonate bauxites would be evaluated with a low EHP.	Medium	B2 = medium, classified according to measurement instructions
Deposit size	96 Mt bauxite (48Mt Al ₂ O ₃) (MDO 2018)	With an average content of 50 % applicable Al the deposit with approx. 257.5 Mt bauxite can be considered as a large deposit (>100 Mt ores) according to the measurement instructions.	High	B2 = medium, classified according to measurement instructions
Ore grade	49.9 % (proven reserves) (MDO 2018)	Considering other top bauxite deposits in the world Trombetas -with an average grade of almost 50 %- can be considered a rich bauxite deposit.	Low	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 of unconsolidated rocks (IAI 2018).	The high ratio of superficial stripping in relation to the amount of ore extraction implies a great surface impact of the	High	A = high, can be derived directly

		open mining operation and is classified with a high EHP.		from available data
Use of auxiliary substances	Bauxite is extracted by strip mining, which is done in a sequential manner in regular strips. The overburden of 10 m clay horizon is excavated and dumped into the adjacent strip in which the ore was previously mined out. The company owns the mining rights of a total of 25,000 hectares, of which 7,000 so far have been mined. Mined ore is hauled by trucks to primary crushers, where it is reduced to a particle size of up to three inches. From the crushers, the ore is transported by conveyor belt to the beneficiation plant, where it is washed and classified by grain size. Bauxite fines are recovered by cyclone and filtering (MRN 2018b).	On site no auxiliary substances are used (with the exception of water) for ore processing.	Low	A = high, can be derived directly from available data
Mining waste	MRN (MRN 2018b) uses strip mining, a technique that avoids the formation of an overburden stockpile. As a result of the beneficiation process, approximately 25 % of bauxite ore leave as tailings (clay fraction) which is dumped in ponds constructed in mined-out areas. The waste material reaches a solid fraction content of 35 % to 40 %. Thickening of tailings is carried without chemical additives. Water reclaimed from the thickening is returned to the beneficiation plant in a closed circuit. End conditions allow for planting native species.	Strip mining with insertion of overburden in previous mines strips and re-utilization of water and thickening of tailings leads to a low EHP as evaluation result.	Low	B1 = medium, can be estimated on the basis of available information
Remediation measures	Reforestation of stripping sites concomitantly to the mining process is implemented since	Total reforestation is expected after end of operations. Old stripping sites are in	Low	B1 = medium, can be estimated

	<p>1979. Since then, 5,752.37 hectares have been rehabilitated and more than 12 million seedlings of native tree species have been planted. Provision for contingencies in 2016 amounted to about 309 million Reais (about 100 million US\$) (MRN 2016, 2018c)</p>	<p>continuous reforestation process (process-parallel rehabilitation) or have already undergone reforestation. Comprehensive programs for monitoring flora, fauna and water quality are in place. Support of conservation of the Saracá-Taquera National Forest and the Trombetas Biological Reserve takes place.</p>		<p>on the basis of available information</p>
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Framework conditions natural environment



Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
<p>Accident hazard due to floods, earthquake, storms, landslides</p>	<p>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.</p>	<p>The EHP for landslides is medium, else the EHP is negligible for earthquakes, floods, tropical storms and the mine is not situated within an arctic environment.</p>	<p>Medium</p>	<p>B2 = medium, classified according to measurement instructions</p>
<p>Water Stress Index (WSI) und desert areas</p>	<p>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.</p>	<p>EHP for water stress is low and the mine is not situated in a desert area.</p>	<p>Low</p>	<p>B2 = medium, classified</p>

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).	There is a medium EHP for protected areas and AZE sites.	Medium	B2 = medium, classified according to measurement instructions
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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?	No No (ASI 2019)
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“	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?	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 (MRN 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 (OECD 2011)
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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