ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Juruti Bauxite Mine

AWAC – Alcoa World Alumina and Chemicals, Brazil

ID: 90

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

Juruti Bauxite Mine

Bauxite

General information

Indicator or criteria	Description and values
Name of mine	Juruti Bauxite Mine
Description of mining area	Juruti Bauxite Mine is an open-pit mine located close to the city of Juruti, in the Brazilian state Pará. More precisely, the mine is located within a protected area of the Amazon Basin, where threatened species and ecological communities (IUCN listed) are present (Alumina Limited 2018). The area of the mine site consists of dissected plateaus (with bauxite and clay) and pediplains (characterized by fluvial and lacustrine deposits) (Costa et al. 2014). Bauxite has developed from weathering cretaceous feldspathic sandstones during tertiary. Nowadays, the bauxite deposit is covered by Belterra clays (Alcoa 2019). Besides the pit itself, the mine site´s infrastructure comprises bauxite beneficiation plants, a rail link and the Juruti port terminal (GVces 2008).
Surface extension	28.59km² 28.59 km² (Image date: 10.11.2016; Viewing height: 6.25 km) (Google Earth)
In operation since	2009 2009 (Alcoa 2019)
Operator	Alcoa Corporation
Owner	AWAC – Alcoa World Alumina and Chemicals
Closest town	Juruti Bauxite Mine is located approx. 35 km S of the municipality of Juruti (GVces 2008).
Province	State of Pará
Country	Brazil
Longitude	-56.18166°
Latitude	-2.49351°

Altitude	36 m a.s.l. City of Juruti: 36 m a.s.l. (Prefeitura Municipal de Juruti n.d.)
Main product and by-products	Main product: Bauxite, by-product: none (Alumina Limited 2019)
On-site processing stages	Bauxite is mined in an open-pit mine. The subsequent processing in the bauxite beneficiation plants comprises crushing and washing of the ore. Following, the processed ore is transported approx. 5 km to the Juruti port terminal (Alcoa 2019) by railway. According to Alumina Limited (2019), 69 % of the bauxite is refined at Alumar refinery in São Luís, which is approx. 1300 km east of Juruti Bauxite Mine, whereas 12 % of the total bauxite shipped is sold to third parties.
Annual production	5.7 million dry metric tons of bauxite(on a zero moisture content) (Alcoa 2019) in 2018.
Proven Reserves	3.5 million dry metric tons of bauxite (on a zero moisture content) (46.7 % Al2O3) (Alcoa 2019)
Probable Reserves	19 million dry metric tons of bauxite (on a zero moisture content) (46.7 % Al2O3) (Alcoa 2019).

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	No indication of acid mine drainage risks has been reported. With respect to the Goldschmidt classification, aluminium (and thus also bauxite as Al ore) is a lithophile element and is mostly oxidic, thereby not prone to AMD.	As Al is a lithophile element and bauxite forms oxidic ore deposits, bauxite mining and beneficiation the environmental hazard potential (EHP) for AMD is low.	Low	B2 = medium, classified according to measuring instructions
Paragenesis with heavy metals	Costas et al. (2014) proved that the bauxite horizon of the regolith sequence of Juruti contains trace elements, among them Cu, Cr and Zn. Especially the values of Cr with 160 ppm are more elevated I comparison to the earth's crust values (50 ppm).	Taking into account that elevated chrome levels are documented, the EHP is evaluated as high.	High	A = high, can be derived directly from available data

Paragenesis with radioactive components	Costa et al. (2014) reported Th values of 30 ppm and U values of 2.9 ppm in the bauxite horizon.	By applying the formula within the measurement instructions, a radioactive component value of 0.7 is obtained ((30/49) + (2.9/24)). With respect to the classification of concentration contents of radioactive components within the measurement instructions, a radioactive component value < 1 has been obtained, the EHP is thus considered to be low.	Low	A = high, can be derived directly from available data
Deposit size	In 2018 proven and probable reserves account of 22.5 Mt bauxite (46.7 % Al2O3) (Alcoa 2019).	A total deposit size of 64 Mt bauxite has been calculated, by taking the proven and probable reserves of 22.5 Mt bauxite (46.7 % Al2O3) (Alcoa 2019) and a production of 41.5 Mt bauxite (46.7 % Al2O3) into account. An initial production of 2.6 Mt bauxite (GVces 2008) during the first 5 years and a subsequent prodution of 5.7 Mt bauxite (Alcoa 2019) during the following 5 years has been considered. Applying the calculation for the deposit size on values published by Alcoa, the deposit can be considered as medium (10-100 Mt) according to the measurement instructions. However, it should be noted that e.g. (GVces 2008) indicate much higher reserves.	Medium	B1 = medium, can be estimated on the basis of available information
Ore grade	46.7 % Al2O3 in reserves (Alcoa 2019)	Considering other top bauxite deposits, Juruti Bauxite Mine with an average grade of 46.7 % can be considered a rich bauxite deposit, whereby a low EHP has been assigned.	Low	A = high, can be derived directly from available data

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Juruti bauxite mine is an open-pit mine (Alcoa 2019).	According to the measurement instructions, the superficial stripping of the weathered bauxite horizon leads to a high surface consumption of the mining operation and is consequently evaluated with a high EHP.	High	B1 = medium, can be estimated on the basis of available information
Use of auxiliary substances	For the extraction, no information about the implementation of auxiliary substances (such as explosives) has been found. The processing on-site includes crushing and washing of the ore, followed by transportation (Alcoa 2019).	The measurement instruction is focused on on-site processing. For on-site processing, no auxiliary substances have been mentioned, therefore the EHP is considered to be low.	Low	B2 = medium, classified according to measurement instructions
Mining waste	TSF's for storing the waste materials after the beneficiation process are considered to have at least a surface of 1 km2 according to satellite imagery interpretation.	When assuming a minimal depth of the TSF of 1 m, the expected volume of the TSF is approx. 1 million m3. According to the measurement instructions, a TSF < 3 million m3 is evaluated with medium EHP.	Medium	C = low, no concrete information, no general specifications in the measuring instructions, (expert) estimate
Remediation measures	A rehabilitation program has been developed and established. For the Juruti Mine, a nucleation technique is used. Thereby, locally adapted plants and animals are expected to	Remediation measures such as the nucleation technique are used, but it is not clear if remediation measures take place accompanying active production.	Medium	C = low, no concrete information, no general

	colonize the environment using small mounds of topsoil to create an undulating land scape. Besides species distribution, this technique aims at trapping surface water and control water runoff (Alumina Limited 2018).	In addition to that, no information about an existing closure plan is available. Therefore the EHP is evaluated with medium.		specifications in the measuring instructions, (expert) estimate

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 Juruti mine there is a high EHP for landslides which determines the evaluation result. The EHP for the other sub-indicators is low.	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 the mine 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	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

	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?	Yes Yes, Alcoa Inc. (ASI 2018)
Aluminium Stewardship Initiative (ASI): Is the mine certified?	Yes Yes (ASI 2019)
International Council of Mining & Metals (ICMM): Is the mine owning company a member?	No No (ICMM 2019), but according to (GVces 2008), Alcoa is sponsoring the Mining, Minerals and Sustainable Development (MMSD) project. The evaluation of the project provided input for the principles of the International Council on Mining & Metals (ICMM)
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 Not specifically mentioned
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 Information not available (RMI 2018)
Responsible Mining Index Company indicator „Environmental sustainability“	Information not available Information not available (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 80% of the Alcoa operating plants are certified against the ISO 14001 (Alcoa n.d.)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes, USA & Australia (World Population Review 2019)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information available
Banking Standards	
WB Standards / IFC Performance Standards: Is the mine financed to a major extend by the world bank?	Yes The MMSD project is sponsored by the world bank and Alcoa (GVces 2008).
Equator Principles (EP): Is the mine financed to a major extend by a bank adherent to the EP?	No information obtained No information available

*by companies own account.

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A Glossary

Table 1 Legend

Environmental hazard potential

low

medium

high

Data quality

low

- 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.

medium

- Assessable on the basis of available information.
- Generalized classification according to measurement instructions.

high

- 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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