

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Los Pijiguaos bauxite mine

Venezuelan government, Venezuela

ID: 98

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>

Los Pijiguaos bauxite mine

Bauxite

General information 	
Indicator or criteria	Description and values
Name of mine	Los Pijiguaos bauxite mine
Description of mining area	Los Pijiguaos bauxite mine is located in the State of Bolivar in Venezuela, close to the Orinoco river. The climate is characterized by annual average temperatures of 25.5°C. (Luque et al. n.d.). The deposit, which is situated at the NW margin of the Guiana Shield, has an irregular shape due to strong erosion processes during uplift of the area. Therefore, mineable parts of the deposit are located on remnants of the previous plateau, which are separated by deep valleys. Mine geology is associated with gibbsitic bauxite (Meyer et al. 2002). Given the fact that the lease area only covers a part of the deposit and that only parts of this concession area are accessible and thus mineable, only half of the entire leased area can be subject to mining (Meyer et al. 2002). According to (Kömölösy / Morrison 2010), access to the mining area is very difficult due to its scattered character and the fact that transportation is dependent on the navigability of the Orinoco river. After mining and processing, the ore is transported about 50 km by train to the Orinoco river and then shipped down the river 630 km to the alumina refinery in Ciudad Guayana (Happel et al. 1998).
Surface extension	22.05km ² 22.05 km ² (Image date: 16.11.2019; Viewing height: 7.94 km) (Google Earth)
In operation since	1987 1987 (Meyer et al. 2002)
Operator	CVG Bauxilum, C.A.
Owner	Venezuelan government
Closest town	The mine is located 500 km south of Caracas and 35 km from the Orinoco River (Soler / Lasaga 2000).
Province	State of Bolivar (Meyer et al. 2002)
Country	Venezuela


Longitude	-66.748688°
Latitude	6.517316°
Altitude	700 m a.s.l. 600-700 m a.s.l. (Soler / Lasaga 2000)
Main product and by-products	Bauxite (Meyer et al. 2002)
On-site processing stages	Happel et al. (1998) explain that the mining operation consists of overburden removal, direct bauxite extraction by hydraulic shovel excavators without blasting, transportation by trucks to an in-pit crusher and transportation by conveyor belt to the stockpile in Suapure valley and subsequent transportation by boat to the alumina refinery in Ciudad Guayana.
Annual production	992,000 t bauxite in 2015 (production decreased from 5.9 Mt bauxite in 2006) (Szczesniak 2015)
Proven Reserves	The reserves of the known bauxite deposit of Los Pijiguaos are 500 Mt in 1985 (Orris et al. 1993).
Probable Reserves	see above

Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	According to the Goldschmidt classification, aluminium (and thus also bauxite as Al ore) is a lithophile element and is mostly oxidic. No indication of acid mine drainage risk has been determined. (Martens et al. 2003) explain that for bauxite mining, no acid rock drainage occurs.	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	Investigations of 450 mines (including Los Pijiguaos) within the Venezuelan Guayana Shield indicated absence of primary deposits	According to the measurement instructions, aluminium ores may be associated with zinc, copper and	Medium	B2 = medium, classified according

	of nickel, platinum-group elements and base metals such as copper, lead and zinc (Orris et al. 1993).	chrome. Therefore, the EHP is classified as medium in consequence.		to measurement instructions
Paragenesis with radioactive components	Leopold (2007) mentioned activity concentrations of 90 Bq/kg Uranium and 665 Bq/kg Thorium for bauxite from Los Pijiguaos bauxite mine.	Leopold (2007) reports uranium and thorium in the Los Pijiguaos bauxite mine. The application of the formula of the measurement instructions on the values of Leopold (2007) reveal values < 1, which leads to a low EHP.	Low	A = high, can be derived directly from available data
Deposit size	The stated reserves of 500 Mt bauxite in 1986 (Orris et al. 1993) was before the production phase of the mine. Therefore, no additional production must be assumed.	The deposit of 500 Mt bauxite can be considered as large (> 100 Mt ores) according to the measurement instructions.	High	A = high, can be derived directly from available data
Ore grade	Grade given for proven reserve is 49 % Al ₂ O ₃ (Meyer et al. 2002)	The last update of the measurement instructions suggests a medium EHP for Al ore grades between > 40 % and < 52 %. Los Pijiguaos bauxite mine with an average grade of 49 % is consequently assigned 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 in unconsolidated rock.	The superficial stripping of the weathered bauxite horizon leads to a	High	A = high, can be derived directly

		high surface consumption of the mining operation and is consequently evaluated in accordance with the measurement instructions with a high EHP.		from available data
Use of auxiliary substances	During extraction and processing, no information about the use of auxiliary substances on-site has been found.	The measurement instruction is focused on the on-site processes. On-site, no auxiliary substances are used or mentioned. Consequently, the EHP is considered to be low. However, it should be noted that crushed ore is transported to the alumina plant in Puerto Ordaz (500 km NE of the mining site), where the ore is processed to Al ₂ O ₃ . The process involved is the Bayer process, where chemical treatment with sodium hydroxide takes place (Barros et al. 2017).	Low	B1 = medium, can be estimated on the basis of available information
Mining waste	On-site no TSF's can be recognized in satellite imagery or have been mentioned by the mine-owners or other sources	Following Meyer et al. (2002), bauxite is mined, crushed in-pit and then transported by conveyor belt to the railhead stockpile. Subsequently, the bauxite is transported to the river and then shipped for further processing to Puerto Ordaz. Thus, no further processing takes place that would require a TSF. Matching to this no TSF structures were observed on-site, therefore the EHP is evaluated as low.	Low	C = low, no concrete information, no general specifications in the measuring instructions, (expert)estimate
Remediation measures	A rehabilitation program has been developed and established. Just after the extraction of bauxite within the first few sectors, the topsoil	The mine closure and rehabilitation is approached progressively while the	Low	A = high, can be derived directly

	which was previously taken of, has been replaced in the extracted areas and trees have been planted (Meyer et al. 2002).	mine is still in production. Accordingly, the EHP is low.		from available data
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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 Los Pijiguaos 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 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.	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	14.29 ^{ooo}
WGI 2 -Political Stability and Absence of Violence/ Terrorism	11.43 ^{ooo}
WGI 3 - Government Effectiveness	7.69 ^{ooo}
WGI 4 -Regulatory Quality	2.4 ^{ooo}
WGI 5 - Rule of Law	3.85 ^{ooo}
WGI 6 -Control of Corruption	0.48 ^{ooo}
EPI (Environmental Performance Index)	63.89
EITI membership	No
International Agreements	
ILO 176	No, not ratified

Others	No OECD member (World Population Review 2019)
Legal framework	
Areas of Law: Environment	<p>Mineral Deposits in Venezuela are owned by the State, which can develop them directly or through State-owned companies or joint venture companies with private entities. Mining of iron ore is reserved to the State, and mining of gold and other “strategic minerals”(not further defined) is reserved to the State or to joint venture companies in which the State has a minimum equity participation of 55 % (Szczesniak 2015). The environmental regime and the permits for mineral projects are regulated by the “Organic Law on the Environment” of 2006, and by several technical and procedural decrees further regulating the provisions of the law, namely on zoning, permitting, environmental studies, technical specifications and related matters applicable to exploration and mining activities. Exploration and mining activities are subject to previous environmental authorizations from the relevant authorities. The first one is the Authorization for the Occupation of Territory (autorización de ocupación del territorio – AOT) and the second permit is the Authorization to Affect Natural Resources (autorización para afectación de recursos naturales – AARN). AOTs require the filing of an environmental questionnaire in an official format, including a general description of the area and of intended activities. AARNs require, even for exploration activities, the filing and approval of an environmental impact assessment (EIA). AARNs include authorization for specific activities and reclamation plans. AARNs usually require the posting of performance bonds in order to guarantee the implementation of the approved reclamation plans. The title holder is required, prior to exploitation, to post a bond for environmental damages resulting from such exploration (Norton Rose</p>

	<p>Fulbright 2016). The “Organic Law on the Environment” does not specifically mention a public consultation process (República Bolivariana de Venezuela 2006).</p>
<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>The important authorities in this context are the Ministerio del Poder Popular para el Proceso Social del Trabajo and the Instituto Nacional de Prevención, Salud y Seguridad Laborales (INPSASEL).</p> <p>The main law on occupational safety and health in Venezuela is the Organic Law on Prevention, Working Conditions and Working Environment (LOPCYMAT) which was adopted in 2005. Besides, the Organic Labour Law of May 7, 2012, sets out provisions concerning the work of children, pregnant and lactating workers, working conditions, and the Labour Inspectorate, among others. In addition, the Venezuelan Commission for Industrial Standards (COVENIN) has established standards on a variety of OSH issues. These regulations address issues such as work in confined spaces, fire risks, personal protective equipment, maximum temperatures in workplaces, and record, classification, and statistics regarding occupational injuries. Workers shall follow the instructions of the employer and internal regulations but have also the right to remove themselves</p>

	<p>from dangerous situations without any sanction. (ILO 2013). No information on specific regulations for the mining sector concerning OHS was found during the literature review.</p>
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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 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?	No information obtained No information available

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?	No No (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?	No information obtained No information available
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



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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