ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Area C

BHP Billiton , Australia

ID: 8

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

Area C

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Area C
Description of mining area	Area C is part of BHP's Western Australian Iron Ore Complex (WAIO) that consists of four processing ore hubs that service five mines. More than 1,000 km of rail infrastructure and port facilities support the complex. The iron ore is transported via rail to Port Hedland, 360 km away from the mine site. (BHP 2019a) Area C consists of various pits within mine site: Packsaddle, North Flank and South Flank Mining began in 2003. Mineralisation at Area C is martite-goethite-ocherous goethite enrichment of the Marra Mamba (North and South Flank ranges) and Brockman (Packsaddle range) banded iron formations (Mindat 2019; Okazaki et al. 2006).
Surface extension	70.69km² 70.69 km² (Image date: 03.08.2018; Viewing height: 16.82 km) (Google Earth)
In operation since	2003 2003 (Mindat 2019)
Operator	BHP Billiton
Owner	BHP Billiton
Closest town	The mine is located 92 km west north west of Newman.
Province	Western Australia
Country	Australia
Longitude	118.964546°
Latitude	-22.916627°

Altitude	710 m a.s.l. 710 m.a.s.l (Google Earth)
Main product and by-products	Main Product: Iron Ore (high-grade hematite lump and fines); by-product: none
On-site processing stages	There is an ore processing plant, primary crusher and an overland conveyor on site (BHP 2013)
Annual production	51.5 Mt iron ore in 2018 (BHP 2019b)
Proven Reserves	No current figures available, only at aggregated level. In 2003 reserves were 203 Mt of iron ore (BHP 2003). In the annual report reserves are reported for the WAIO complex differentiated by ore type. Based on Okazaki et al. (2006) it is assumed that Marra Mamba ore is mainly mined at Area C. 430 Mt of iron ore (Marra Mamba ore) 62.4 % Fe (BHP 2019b)
Probable Reserves	1,340 Mt of iron ore (Marra Mamba ore) 61.6 % Fe Marra Mamba Ore (BHP 2019b)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The potential to encounter small volumes of potentially acid-forming materials (PAD) is noted to be (BHP, 2018). However, the Mine Closure Plan states that the due to the size of the operation "the cumulative impact of potentially acid forming mine waste may be environmentally significant if appropriate AMD management strategies" are not implemented (BHP 2016).	Due to presence of sulphide minerals and detailed technical analysis it is estimated that preconditions for mine drainage are present resulting in a medium EHP.	Medium	A = high, can be derived directly from available data
Paragenesis with heavy metals	No specific information on Area C obtained, but no indication for arsenic issues are noted in environmental review documents.	As there is no direct information on the paragenesis with heavy metals available, the measurement instructions are referred to. These	Medium	B2 = medium, classified according to measurement instructions

		indicate that oxidic iron ores can be associated with heavy metals such as lead, zinc, copper, chrome, and arsenic. Accordingly, heavy metals and arsenic may have a limited relevance in the extraction of oxidic iron ores, leading to a medium EHP (Dehoust et al. 2017).		
Paragenesis with radioactive components	No specific information on Area C obtained. However, the geochemical property of iron ores causes it to scavenge radionuclides and heavy metals, leading to trace levels of uranium (Cooper 2005).	In line with the measurement instructions, with possible indication of Thorium and Uranium, a Medium EHP is assigned.	Medium	B2 = medium, classified according to measurement instructions
Deposit size	Assuming current production levels of ca. 50 Mt/pa iron at 62.4 % Fe. A total of ca. 500 Mt of iron have been produced since 2003. Adding the reserves the total deposit size totals to ca. 1500 Mt of iron content (BHP 2019b).	According Petrow et al., Area C is classified as a large project and is hence given a high EHP (Dehoust et al. 2017).	High	A = high, can be derived directly from available data
Ore grade	62.4 % Fe (BHP 2019b)	Ore grades at the Area C mine are in the high-grade category according to Priester et al. (2019). Therefore, according to the measuring instructions a low EHP is awarded.	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-cut mine, involving blasting activities (BHP 2019a)	Open-pit mines are usually limited to an area that is only slightly larger than the projection of the deposit body to the surface. Accordingly, the EHP resulting from the mining method is medium.	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	There are no auxiliary substances used during excavation. However, the mine complex also hosts primary crushing facilities, where the use of ammonium nitrate is noted (BHP 2018).	As the extraction and processing likely involves steps that require the use of auxiliaries, which are used on site, the EHP resulting from extraction and processing is estimated to be medium.	Medium	B1 = Assessable on the basis of available information
Mining waste	Mine waste consists of sub-grade ore stockpiles and waste rock heaps (BHP 2018).	Mine waste is either stockpiled or reused and a detailed mine waste management system is in place. Therefore, a Low EHP rating is assigned. No tailings storage facility could be identified in satellite images.	Low	A = high, can be derived directly from available data
Remediation measures	The overburden is stockpiled and progressively placed back into mined pits. Closure and rehabilitations planning have been embedded within the 'Life of Asset' plans (BHP 2016, 2018).	A full developed and government approved Mine Closure Plan addressing decommission, rehabilitation and closure strategy exist. A Low EHP rating is assigned.	Low	A = high, can be derived directly from available data

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 (Dehoust et al. 2017a)). 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 the sub-indicators landslides and floods is low. The EHP for the sub-indicators storms and earthquakes are medium, resulting in an overall medium EHP.	Medium	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 but it is situated in a desert area, which results in a High EHP.	High	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	94.58 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	77.62 °°°
WGI 3 - Government Effectiveness	92.31 °°°
WGI 4 -Regulatory Quality	98.08 °°°
WGI 5 - Rule of Law	93.27 °°°
WGI 6 -Control of Corruption	92.79 °°°
EPI (Environmental Performance Index)	74.12
EITI membership	Other (has announced its commitment to join the EITI)
International Agreements	
ILO 176	Not ratified

Others	OECD member
Legal framework	
Areas of Law: Environment	All stages of mining require environmental authorization. Depending on the kind of operation, varying degrees of public consultation appeal. Projects involving environmental issues require an Environmental Impact Assessment. Projects or waste storage facilities that might have impact of national environmental significance might require approval under the Environmental Protection and Biodiversity Conservation Act (projects affecting, e.g. World Heritage, threatened species etc.). Projects with significant impact on water resources require the Commonwealth minister to get advice from the Independent Experts Scientific Committee before approving any proposal. Some states have specific legislation concerning mining waste; e. g. In Victoria, Western Australia and Queensland guidelines for the design and operation of TSFs have been issued. Holders of mining rights are liable for the rehabilitation of mining areas. Liability is only discharged once all obligations as stated in the mine closure plan have been fulfilled (Woods / Rifici 2018).

Areas of Law: Occupational Health and Safety (OHS)	Following the Work Health and Safety Act (WHS), most jurisdictions in Australia provide a balanced and nationally consistent framework to health and safety of workers at workplaces (Safe Work Australia 2018). New South Wales, Queensland and Western Australia have laws directly addressing the health and safety in the mining sector including penalties for non-compliance. WHS laws impose obligations on ensuring the safety of all persons working on site, this requires officers and directors of corporations to exercise due diligence to ensure compliance with WHS laws (Woods / Rifici 2018).

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?	Yes Yes (ICMM 2019)
Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?	Not applicable Not applicable
Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?	Not applicable Not applicable

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 2018a)
Responsible Mining Index Company indicator „Working conditions“	0.550 0.550 (RMI 2018b)
Responsible Mining Index Company indicator „Environmental sustainability“	0.480 0.480 (RMI 2018b)
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?	Yes Yes (ASSF 2018)
Australian Steel Stewardship Forum: Is the mine certified?	No information obtained No information obtained (ASSF 2018)
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes BHP environmental management based on ISO14001 (BHP 2019a)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes (London & Melbourne)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes
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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