

# ÖkoRess III

## Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

**Yandi Iron Ore Mine**

**BHP Billiton , Australia**

ID: 4

## 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”<sup>1</sup> (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.

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<sup>1</sup>TEXTE 87/2017 <https://www.umweltbundesamt.de/publikationen/discussion-of-the-environmental-limits-of-primary>

# Yandi Iron Ore Mine

## Iron ore

General information	
Indicator or criteria	Description and values
Name of mine	Yandi Iron Ore Mine
Description of mining area	The Yandi mine is situated in the Hamersley Province / Pilbara Region in Western Australia in the area of the Marillana Creek. Rio Tinto's adjacent Yandicoogina mine is a separate operation (Mining Atlas 2015), but both mine the same ore body (Rio Tinto 2010).
Surface extension	57.32km <sup>2</sup> 57.32 km <sup>2</sup> (Image date: 03.08.2018; Viewing height: 13.05 km) (Google Earth)
In operation since	1992 1992 (BHP 2018a)
Operator	BHP Billiton
Owner	BHP Billiton
Closest town	Newman, 90 km southeast (Mindat 2019)
Province	Western Australia (Mindat 2019)
Country	Australia
Longitude	119.079968°
Latitude	-22.72077°
Altitude	550 m a.s.l. Around 550 m a.s.l. (Google Earth)
Main product and by-products	Iron ore
On-site processing stages	Extraction and processing up to crushing and blending but no further steps on-site (MDO 2019).



Annual production	BHP produced 64 Mt of iron ore at Yandi in 2018 (BHP 2018a).
Proven Reserves	No information obtained
Probable Reserves	No information obtained

## Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Yandi belongs to the Channel Iron Deposits (CID), which are mined in the Hamersley Province (see, e.g., Ramanaidou / Morris 2010). A low to medium risk to AMD is reported for the geological framework of Yandi (EPA 1995, 2018; O'Brien 2009; Rio Tinto 2018).	Based on the statement by the Australian Environmental Protection Authority (1995) and given that also other available literature does not mention an AMD risk related to the Yandi ore, a low EHP is indicated in this category.	Low	A = high, can be derived directly from available data
Paragenesis with heavy metals	No indication of paragenesis with heavy metals.	Mining of metals generally poses a certain risk with regards to paragenesis with heavy metals. Accordingly, the EHP is evaluated 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.	In accordance with the measurement instructions, iron ore deposits are evaluated with a medium EHP, if no other information is available.	Medium	B2 = medium, classified according to measurement instructions

Deposit size	The reserves in BHP Billiton's annual report are aggregate numbers for all their Australian operations. Accordingly, current reserves can only be estimated based on the annual capacity and time of production. BHP reported that up until 2017 1 billion tons of ore have been produced at Yandi. In the remaining 6 years of production at a capacity of 80 mt of ore per annum, another 480 Mt of ore could be mined. Assuming an average ore grade of 56.6 % Fe, the deposit contains a total of approximately 500 Mt of iron (BHP 2017a, 2018a).	According to the measurement instructions, such a deposit size falls into the category "medium" leading to a medium EHP.	Medium	C = low, no concrete information, no general specifications in the measurement instructions, (expert) estimate
Ore grade	BHP (2018) indicates an average grade of 56.6 % for all their Channel Iron Deposits (CID) in Western Australia.	Priester et al. (2019) categorize iron ore with grades between 30 and 60 % Fe as average grade. Accordingly, the environmental hazard potential caused by the ore grade is medium.	Medium	A = high, can be derived directly from available data

## Technology



Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	The ore at Yandi is mined in open pit.	According to the measurement instructions a medium EHP is indicated for solid rock open pit mining.	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	BHP Billiton (2018) indicates that at each mining hub - Newman, Yandi, Mining Area C	Based on the evaluated literature it is unclear, whether processing at Yandi	Medium	A = high, can be derived directly

	and Jimblebar - ore is crushed, beneficiated (where necessary) and blended to create high-grade hematite lump and fines products. Three primary crushers, three ore handling plants, and a stockyard blending facility are in operation. According to ChemEurope (n.d.) most channel iron deposits are upgraded via washing of the pisolite gravels to remove the cements and matrix.	includes auxiliary materials. As a conservative estimate a medium EHP is indicated according to the default recommendation.		from available data
Mining waste	A lease-wide environmental management program for the Yandi operation was required by the Environmental Protection Authority (1995) including waste management of overburden, liquid, solid and gaseous wastes. In recent BHP annual reports no details concerning waste management at Yandi are given (BHP 2017b, 2018a).	With the Australian Environmental Protection Authority, a strong controlling authority is in place but no specific information concerning waste management at Yandi could be found. Aerial photos indicate that several large waste heaps exist. Tailings storage facilities for wet residues could not be determined. Therefore, the EHP is estimated to be medium.	Medium	C = low, no concrete information, no general specifications in the measurement instructions, (expert) estimate
Remediation measures	BHP Billiton's general comment on remediation measures at their mine sites is that they provide for operational closure and site rehabilitation and that their operating and closed facilities are required to have closure plans. This includes an internal audit function which tests their effectiveness (BHP 2017).	No information on accompanying renaturation or recultivation was found. EPA documents require that a closure and rehabilitation plan is elaborated. BHP Billiton itself states that it assumes that a satisfactory outcome for rehabilitation will be achieved for all infrastructure and land except for the pits (BHP 2016). Their residual impact will be offset financially. Based hereon it is estimated that some residual impact from mining will remain in the area even	Medium	A = high, can be derived directly from available data

		after closure and rehabilitation and the EHP is evaluated as medium.		
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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.	The environmental hazard potentials (EHP) for earthquakes and storms is medium, while other hazards are minor.	Medium	B2 = medium, classified according to measurement instructions
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 WSI around the mine is low but the mine is located within a desert climate.	High	B2 = medium, classified according to measurement instructions
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 mine is not close to protected areas that fall into the scope of the evaluation.	Low	B2 = medium, classified according to measurement instructions

## State Governance

Indicators	
WGI 1 -Voice and Accountability	94.58 <sup>ooo</sup>
WGI 2 -Political Stability and Absence of Violence/ Terrorism	77.62 <sup>ooo</sup>
WGI 3 - Government Effectiveness	92.31 <sup>ooo</sup>
WGI 4 -Regulatory Quality	98.08 <sup>ooo</sup>
WGI 5 - Rule of Law	93.27 <sup>ooo</sup>
WGI 6 -Control of Corruption	92.79 <sup>ooo</sup>
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
<b>Legal framework</b>	
Areas of Law: Environment	<p>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).</p>

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).
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## 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 2018)
Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?	Yes Yes (MAC 2018)
Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?	No information available No mention of application of TSM protocols outside of Canada in the Sustainability Report (BHP 2018b)

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“	0.550 0.550 / 1.000 (RMI 2018)
Responsible Mining Index Company indicator „Environmental sustainability“	0.480 0.480 / 1.000 (RMI 2018)
Responsible Steel (RS): Is the mine owner a member of the RS?	No No (Responsible Steel 2018)(Responsible Steel 2019)
Responsible Steel (RS): Is the mine certified?	No No (Responsible Steel 2018)(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)
<b>ISO and CSR reporting</b>	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (BHP 2018b)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (Australia) (BHP 2018c) (BHP 2020)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (Australia) (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information availbale
<b>Banking Standards</b>	
WB Standards / IFC Performance Standards: Is the mine financed to a major extend by the world bank?	No information obtained No information availbale
Equator Principles (EP): Is the mine financed to a major extend by a bank adherent to the EP?	No information obtained No information availbale

\*by companies own account.

## Sources

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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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- Öko-Institut e.V. (Institute for Applied Ecology)