

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Hamersley Iron Ore Mines - Pilabara

Rio Tinto , Australia

ID: 1

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>

Hamersley Iron Ore Mines - Pilabara

Iron ore

General information 	
Indicator or criteria	Description and values
Name of mine	Hamersley Iron Ore Mines - Pilabara
Description of mining area	The mines are spread across a large area (up to 200 km distance between the mines that are furthest away from each other), the mining region is referred to as Pilbara region or Hamersley range The mine complex includes the following mines: Brockman 2 Mine, Brockman 4 Mine, Marandoo Mine, Mount Tom Price Mine, Nammuldi Mine, Paraburdoo Mine, Channar, Easter Range, Western Turner Syncline Mine, Yandicoogina Mine (Rio Tinto 2018a; b; c; d)
Surface extension	384.67km ² 384.67 km ² (Image date: 26.11.2019; Viewing height: 10.66 km) (Google Earth)
In operation since	1966 1966 (Rio Tinto 2020)
Operator	Hamersley Iron Pty Ltd.
Owner	Rio Tinto
Closest town	Ca. 330 km northeast of the mines, the closest larger city is Port Hedland with a population of 14,000 people. Western Australia is not very densely populated, therefore the only really large town is Perth circa 1,500 km southwest of the Pilbara region (Government of Western Australia 2018).
Province	Western Australia
Country	Australia
Longitude	116.76666°
Latitude	-21.88333°
Altitude	747 m a.s.l. 747 m a.s.l. (Google Earth)

Main product and by-products	Main-product: iron ore; by-products: none. Marketable quantities of ore plus concentrates and pellets (Rio Tinto 2018e).
On-site processing stages	Drill and blast, crushing, heavy-medium separation (HMS) and wet high-intensity magnetic separation (MDO 2018).
Annual production	Annual production amounted to ca. 207 million tonnes of iron ore in 2017 (Rio Tinto 2018d).
Proven Reserves	1554 Mt (Rio Tinto 2018e)
Probable Reserves	425 Mt (Rio Tinto 2018e)

Geology 				
Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The deposit contains world-class high-purity hematite ore bodies hosted within banded iron formations. Geochemical risk assessments have been completed for many of the mined deposits. The assessments have been conducted in accordance with industry standards. The results indicate, that most deposits show a low acid mine drainage risk, however some pose a moderate risk. Some of the present rock types pose an AMD risk but are unlikely to be exposed during operations (e.g., sulfidic black shale) (Rio Tinto 2018f; Taylor et al. 2001)	Sulfidic rock types are present but not predominant, also iron is a siderophil element, therefore AMD poses a medium environmental hazard potential (EHP).	Medium	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	No indication of paragenesis with heavy metals could be determined.	Mining of metals generally poses a certain risk to contamination with	Medium	B2 = medium, classified according

		heavy metals, accordingly the EHP is medium.		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 current ore reserve is 1,979 Mt (Rio Tinto 2018e).	With an estimated average ore grade of 60 % Fe that adds up to ca. 1200 Mt of iron content. The first mine of the Hamersley unit started production in 1966 and produced ca. 40 Mt of iron. Calculating with an average production of ca. 100 Mt and 50 years of production, the total size of the deposit is roughly estimated to be 6,200 Mt (Rio Tinto 2013). The rough estimation of the deposit size ranges between big, very big and possibly gigantic according to Petrow et al. (2008; In: Dehoust et al. 2017b). Accordingly, the EHP is high.	High	A = high, can be derived directly from available data
Ore grade	The iron (Fe) ore grade mined at Hamersley ranges between 58.5 % and 63.9 % Fe, the vast majority being above 60 % Fe (Eglseder / Cruden 2015; Rio Tinto 2018e).	Compared to other globally mined iron ores, the mine has a rather high grade. Iron ore from BIF (Banded Iron Formations) in Australia is often referred to as high-grade iron ore. Priester et al. (2019) categorize iron ore with grades higher than 60 % as high grade. Accordingly, the	Low	A = high, can be derived directly from available data

		environmental hazard potential caused by the ore grade is low.		
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Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Hard rock open-pit mining (MDO 2018)	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	The ore is drilled and blasted in benches and then loaded into haul trucks by shovels, hydraulic excavators or front-end-loaders, and transported to the primary crusher. It is then processed in a crushing and screening plant to produce fine ore and lump ore ready for shipping. The processed iron ore type varies from lump to fines products. The ore is crushed, treated in a concentrator by heavy-medium separation (HMS) and wet high-intensity magnetic separation (WHIMS) to produce lump and fines products. The Silvergrass mine, which is part of the Pilbara operations produces low-phosphorous ore to maintain the companies' blend product (MDO 2018). All products are transported from the	HMS can include the application of reagents. Beside, only physical separation methods are applied. Accordingly, processing poses a low EHP.	Low	B2 = medium, classified according to measurement instructions

	mines by Hamersley's own rail system to the port for export (ibid.).			
Mining waste	Interpretation of satellite images indicates that several tailings storage facilities are used for storage of wet processing residues (at least five can be identified from satellite images). E.g. the tailings storage facility at the Yandicoogina mine site is likely to store more than 3 million m ³ of tailings (own estimation from satellite image and elevation).	According to the definition of the ICOLD (2011) at least one of the tailings storage facilities is very likely to be large. Accordingly the EHP resulting from waste management is high.	High	B1 = medium, can be estimated on the basis of available information
Remediation measures	Closure planning must be integrated into operational activities There is a detailed remediation plan for each mine where e.g., progressive backfill, revegetation, landscape design, decontamination etc. are addressed (Rio Tinto 2014a, n.d.).	There are detailed plans for mine closure in place, moreover the mine closure is approached progressively while the mine is still in production. Accordingly, the EHP -due to weak remediation measures- is low.	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). Metrics are directly taken from the given risk assessment. The indicator total	There is a medium risk to earthquakes and a high risk for tropical storms.	High	B2 = medium, classified according to measurement instructions

	is determined by the highest hazard level of the sub-indicators.			
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 area of Hamersley shows high water stress and lies within a desert area.	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).	Protected areas lie within the range of the Hamersley mine complex.	High	B2 = medium, classified according to measurement instructions

State Governance

Indicators	
WGI 1 -Voice and Accountability	94.58 x
WGI 2 -Political Stability and Absence of Violence/ Terrorism	77.62 x
WGI 3 - Government Effectiveness	92.31 x
WGI 4 -Regulatory Quality	98.08 x

WGI 5 - Rule of Law	93.27 x
WGI 6 -Control of Corruption	92.79 x
EPI (Environmental Performance Index)	74.12
EITI membership	Other (has announced its commitment to join the EITI)

International Agreements

ILO 176	Not ratified (ILO 2018)
Others	Not applicable

Legal framework

<p>Areas of Law: Environment</p>	<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>
<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>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).</p>

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 2019)
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 (Rio Tinto 2018g)
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?	Not applicable Not applicable (RMI 2018)
Responsible Mining Index Company indicator „Working conditions“	0.570 0.570 / 1.000 (RMI 2018)

Responsible Mining Index Company indicator „Environmental sustainability“	0.447 0.447 / 1.000 (RMI 2018)
Responsible Steel (RS): Is the mine owner a member of the RS?	No information obtained No information obtained
Responsible Steel (RS): Is the mine certified?	No information obtained No information obtained
Australian Steel Stewardship Forum (ASSF): Is the owner a member of the ASSF?	No No (ASSF 2018)
Australian Steel Stewardship Forum: Is the mine certified?	No No (ASSF 2018)
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (Rio Tinto 2014b)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes (UK) (Rio Tinto 2018h)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (UK) (OECD 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.

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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