

# ÖkoRess III

## Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

**Robe River Iron Ore Mines**

**Rio Tinto , Australia**

ID: 7

## 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>

# Robe River Iron Ore Mines

## Iron ore

General information 	
Indicator or criteria	Description and values
Name of mine	Robe River Iron Ore Mines
Description of mining area	Robe River is located in the Hamersley Range in the Pilbara region of Western Australia. Mesa J, which was one of the major mines in the complex is no longer in operation. The Pilbara region is known to be rich in iron ore mineralisation and comprises of both Proterozoic and Archaean rocks. Both mines produce pisolitic iron ore products (Rio Tinto 2009).
Surface extension	186.38km <sup>2</sup> 186.38km <sup>2</sup> (Image date: 01.12.2018; Viewing height:7.86 km) (Google Earth)
In operation since	1994 Mesa J: 1994; Mesa A: 2010; West Angelas: 2002 (Mining Link 2019)
Operator	Rio Tinto
Owner	Rio Tinto
Closest town	Mesa J is located 15 km south west of Pannawonica town in the Pilbara region of Western Australia. The mine derives its name from the Robe River. West Angelas is located 110 km north west of Newman (Rio Tinto 2015).
Province	Western Australia
Country	Australia
Longitude	Robe Valley Hub: 115.86527° West Angelas: 118.455293°
Latitude	Robe Valley Hub: -21.673611° West Angelas: -23.102284°
Altitude	744 m a.s.l. Robe Valley Hub: 104 m.a.s.l; West Angelas: 744 m.a.s.l

Main product and by-products	Main Product: Iron ore; by-product: none
On-site processing stages	The mines use a truck & shovel method for extraction. The ore is then transported by trucks to a primary crusher, shared by a number of mines in the region, for crushing to produce fine ore and lump ore. There is no on-site processing reported.
Annual production	Robe Valley: 31.947 Mt iron ore (Rio Tinto 2019a) West Angelas: 32.672 Mt iron ore (Rio Tinto 2019a) Total: 64.619 Mt iron ore
Proven Reserves	Robe Valley: 148 Mt iron ore, 56.6 % Fe (Rio Tinto 2019a) West Angelas: 155 Mt iron ore, 62.2 % Fe (Rio Tinto 2019a) Total: 303 Mt iron ore
Probable Reserves	Robe Valley: 222 Mt iron ore, 56.2 % Fe (Rio Tinto 2019a) West Angelas: 78 Mt iron ore, 61.3 % Fe (Rio Tinto 2019a) Total: 300 Mt iron ore

## Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	According to a closure planning concept by SKM Mesa J “shows very low potential for acid generation through oxidation of waste or sub grade material” (SKM 2005).	Since no current information could be obtained, the assessment relates to the measuring instruction. Iron is a siderophile element. Siderophile elements often are sulfidic but also mined in oxide ores as in the present case. Sulphide minerals are present but not predominant accordingly, preconditions for acid mine drainage result in a medium EHP (Dehoust et al. 2017b).	Medium	B2 = medium, classified according to measuring instructions

Paragenesis with heavy metals	No specific information on Robe River Mines 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 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. 2017b).	Medium	B2 = medium, classified according to measurement instructions
Paragenesis with radioactive components	No specific information 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 for the indicator paragenesis with radioactive components.	Medium	B2 = medium, classified according to measurement instructions
Deposit size	Mesa J has been in operation since 1994, Mesa A since 2010 and West Angelas since 2002 (Mining Link 2019). Mesa J had a max output of ca. 35 Mt and is now reaching its end of production. Mesa A mainly replaced Mesa J's production (Mining Link 2019), so the Robe Valley Hub is assumed to have produced ca. 30 Mt per year, totalling to ca. 750 Mt of iron ore until today. Calculating with the same annual production for West Angelas a total of 500 Mt of iron ore has been produced. Adding the reserves a total of ca. 1850 of iron ore have been produced. Assuming an	Treating the Robe Valley mine complex as a single entity, the duration of production (starting in 1994) to the continued expansion of projects (more resources are being developed at both the Mesa and West Angleas sites (Rio Tinto 2018a)) leads to this deposit size being classified as a Medium deposit according to the measuring instructions.	Medium	A = high, can be derived directly from available data

	average ore grade of 55 % Fe the deposits contained a total of 1000 Mt of iron.			
Ore grade	Robe Valley: 56.6 % Fe in reserve (Rio Tinto 2019a) West Angelas: 62.2 % Fe in reserve (Rio Tinto 2019a)	Iron ore from the Pilbara region and the Robe Valley is often referred to as high-grade iron ore. Priester et al. (2019) categorize iron ore with grades above 60 % as high grade deposits. Since the average ore grade is not above 60%, a medium EHP is awarded according to the measuring instructions.	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	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	No detailed information on processing could be obtained. At Mesa J dry and wet processing facilities are in operation (Rio Tinto 2019a).	Wet processing could potentially include the use of auxiliary substances. Accordingly a medium EHP resulting from the use of auxiliary substances is medium.	Medium	B1 = medium, can be estimated on the basis of available information
Mining waste	Mine waste consists of sub-grade ore stockpiles and waste dumps. The waste dumps	According to the definition of the International Commission on Large	High	A = high, can be derived directly

	have been designed to incorporate water management features (Strategen, 2006). Moreover, there are 5 tailings storage facilities at Mesa J (2 are inactive) of which two have structural heights higher than 15m (29 m and 18 m). Both large dams are also active (Rio Tinto 2019b).	Dams two of the tailings storage facilities are defined as large. Accordingly the EHP resulting from waste management is high.		from available data
Remediation measures	Selective progressive backfilling of mine pit is undertaken where practicable. Over the life of the mine progress removal and rehabilitation of 2250 ha of native vegetation is planned (2870 ha of area is subject to disturbance). According to the mine closure plan, borrow pits will be rehabilitated as soon as possible (Strategen 2006).	Given the levels and type of rehabilitation plans it is assumed that backfilling of the mine in parallel to ongoing mining is taking place. Accordingly the EHP resulting from 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 (Dehoust et al. 2017b). 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 floods and landslides are low. The EHP for the sub-indicator earthquakes is medium and high for storms resulting in an overall high EHP.	High	A = high, can be derived directly from available data

<p>Water Stress Index (WSI) und desert areas</p>	<p>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.</p>	<p>The water stress for the mining area is low but it is situated in a desert area, which results in a High EHP.</p>	<p>High</p>	<p>A = high, can be derived directly from available data</p>
<p>Protected areas and AZE sites</p>	<p>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).</p>	<p>The mining area is not situated in designated protected areas and AZE sites, which results in a low EHP.</p>	<p>Low</p>	<p>A = high, can be derived directly from available data</p>

## State Governance

<p><b>Indicators</b></p>	
<p>WGI 1 -Voice and Accountability</p>	<p>94.58<sup>ooo</sup></p>
<p>WGI 2 -Political Stability and Absence of Violence/ Terrorism</p>	<p>77.62<sup>ooo</sup></p>
<p>WGI 3 - Government Effectiveness</p>	<p>92.31<sup>ooo</sup></p>
<p>WGI 4 -Regulatory Quality</p>	<p>98.08<sup>ooo</sup></p>
<p>WGI 5 - Rule of Law</p>	<p>93.27<sup>ooo</sup></p>

WGI 6 -Control of Corruption	92.79 °°°
EPI (Environmental Performance Index)	74.12
EITI membership	Other (has announced its commitment to join the EITI)
<b>International Agreements</b>	
ILO 176	Not ratified
Others	OECD member
<b>Legal framework</b>	

<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 2019)
Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?	Yes Yes (MAC - The Mining Association of Canada 2019)
Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?	No information available Not indicated in company documents.
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“	0.570 0.570/1.00 (RMI 2018b)

Responsible Mining Index Company indicator „Environmental sustainability“	0.477 0.477 /1.00 (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?	Not applicable Not applicable
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?	Not applicable Not applicable
<b>ISO and CSR reporting</b>	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes – all mines are covered under the Rio Tinto ISO framework (Rio Tinto 2018b; Strategen 2006)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes – UK
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes – UK & Australia
ISO 26000: Does the mine implement ISO 26000?*	No information obtained Not indicated in company documents.
<b>Banking Standards</b>	
WB Standards / IFC Performance Standards: Is the mine financed to a major extend by the world bank?	No information obtained Not indicated in company documents.
Equator Principles (EP): Is the mine financed to a major extend by a bank adherent to the EP?	No information obtained Not indicated in company documents.

\*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

### **Publisher:**

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Project period: 03/2018 –02/2021

The research project has been commissioned by the German Environment Agency as part of the Environmental Research Plan of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and funded by the Federal Government (FKZ: 3717 35 306 0).

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