ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Solomon Hub

Fortescue Metals Group Ltd., Australia

ID: 5

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

Solomon Hub

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Solomon Hub
Description of mining area	Solomon Hub is located within the Hamersley Range and contains Banded Iron Formations (BIF). The complex consist of the mines Firetail and Kings (Mining Technology 2019).
Surface extension	74.82km^2 74.82 km ^{2} (Image date: 03.12.2019; Viewing height: 8.72 km) (Google Earth)
In operation since	2013 2013 (Mining Technology 2019)
Operator	FMG Solomon Pty Ltd.
Owner	Fortescue Metals Group Ltd.
Closest town	The closest city is Tom Price 60 km to the south. The capital of Western Australia Perth is located 1,100 km SW of the mine (MDO 2019).
Province	Western Australia (MDO 2019)
Country	Australia
Longitude	117.873234°
Latitude	-22.145447°
Altitude	600 m a.s.l. 600 m a.s.l. (Google Earth)
Main product and by-products	Iron ore fines (Fortescue 2018a)
On-site processing stages	Crushing and grinding and ore processing (Fortescue 2018a)

Annual production	Production capacity of 70 to 75 Mt of iron ore per annum. No information concerning the actual production by Fortescue is available (Fortescue 2018a)
Proven Reserves	116 Mt (Fortescue 2018a)
Probable Reserves	558 Mt (Fortescue 2018a)

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	During assessment and approval of an expansion plan of the Solomon Hub, geochemical testing on the tailings indicate a low risk for acid mine drainage (Tetra Tech 2015). However, within the planned expansion area, locations with low grade lignite have been identified that have a high sulphur (S) grade (>0.5 % S) have been determined to cause a high probability for the formation of acid or metalliferous drainage. In consequence, Fortescue is required to complete and implement a lignite study plan prior to the commencement with the expansion (EPA 2016).	Considering the risk for AMD of the identified lignite rich areas, a high risk for AMD could be assumed. However, only a small area that is not being mined yet is affected by the risk. Also no further indication for AMD has been identified. Accordingly, the Environmental hazard potential (EHP) for AMD is medium.	Medium	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 to contamination with heavy metals, accordingly the EHP is medium	Medium	B2 = medium, classified according to measurement instructions

Paragenesis with radioactive components	Samples within the tailings disposal area indicate that thorium concentrations in the groundwater are elevated above the regional groundwater composition. The concentration is above the Investigative Trigger Values (ITV) meaning that it should be monitored The highest measured concentration in a sample was 0.7 µg/L (Tetra Tech 2014). However, the levels of thorium are still within the limits of natural groundwater according to Hem (Hem 1985).	Samples indicate that slightly elevated levels of thorium are present. Since no further information on radioactive components is available the EHP is evaluated as medium in accordance with the measurement instructions.	Medium	B1 = medium, can be estimated on the basis of available information
Deposit size	The production at Solomon Hub started in 2013 with a projected mine life of 20 years. At a production capacity of 70 Mtpa the total deposit size adds up to ca. 1400 Mt. At a grade of ca. 57 % a total of ca. 800 Mt of Fe is contained in the deposit (Mining Technology 2019).	The deposit size is medium according to Petrow (In: Dehoust et al. 2017b). Larger deposits potentially have a greater expected total impact on the natural environment. Considering the reported reserves, Solomon Hub's EHP resulting from the deposit size is medium.	Medium	A = high, can be derived directly from available data
Ore grade	57.3 % (Fortescue 2018a)	The mine is located within the Hamersley Range which is often referred to as high grade iron ore (Egglseder / Cruden 2015). Grade models compiled by the USGS indicate that compared to other deposits the ore is rather rich (Cox / Singer 1986).	Medium	B1 = medium, can be estimated on the basis of available information

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Both mines, Firetail and Kings, are mined in solid rock open pit operations (Mining Technology 2019; Rabiee 2014).	The impacts on the surface of mining projects are related to the mining method. The impact of open pit mines is usually limited to the size of the ore body. Accordingly the environmental hazard potential resulting from the mining method at Solomon Hub is medium.	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	Following the open-pit load and haul mining, the ore is crushed and grinded. Afterwards the ore is processed in a dry and or a wet circuit, depending on the size of the ore fragments (Fortescue 2018a).	No concrete information concerning the ore processing could be found. However, the fact that a wet processing circuit is used, indicates that a flotation process is probable which involves the use of potentially toxic chemical reagents. Therefore, the Environmental Hazard Potential resulting from the ore processing is high.	High	C = low, no concrete information, no general specifications in the measurement instructions, (expert) estimate
Mining waste	Overburden and waste are placed into mined-out areas (Rabiee 2014). Wet processed residues are stored in valley tailings storage facilities (TSF). Two TSFs are planned, however, currently only one is visible in aerial photos. The iron below the TSF areas is first mined prior to construction of the facilities.	Two large TSFs are planned with structural heights above 15 meters which are defined as large dams according to ICOLD. The final volume of the two TSFs is planned to reach 148 and 84 Mt of tailings. Accordingly, the	High	B1 = medium, can be estimated on the basis of available information

	The maximum embankment heights for the TSFs is capped at 100 and 115 meters respectively (FMG 2010).	EHP from the waste management is high.		
Remediation measures	There is a detailed rehabilitation plan for Solomon Hubs which foresees a progressive rehabilitation during the mining process (FMG 2015).	Since progressive remediation measures during operation is foreseen, the Environmental Hazard Potential for the indicator 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 is determined by the highest hazard level of the sub-indicators.	The hazard is medium for earthquakes and high for storms, while other hazards are minor.	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 WSI around the mine is low but the mine is located within a desert climate.	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 mine is not close to protected areas as defined in the ÖkoRess evaluation method.	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?	No No (ASI 2018)
Aluminium Stewardship Initiative (ASI): Is the mine certified?	No No (ASI 2018)
International Council of Mining & Metals (ICMM): Is the mine owning company a member?	No No membership (ICMM 2018) Commitment to ICMM's Sustainable Development Principles (Fortescue 2018b)
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 No (MAC 2019)

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“	No No (RMI 2018b)
Responsible Mining Index Company indicator „Environmental sustainability“	No No (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?	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 (Fortescue 2018b)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (Australia) (Fortescue Metals Group Ltd. 2018c)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (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.

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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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