

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Olympic Dam

BHP Billiton , Australia

ID: 56

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>

Olympic Dam

Copper

General information



Indicator or criteria	Description and values
Name of mine	Olympic Dam
Description of mining area	Located 560 kilometres north of Adelaide, Olympic Dam is a large mine hosting copper, gold, silver and uranium. The deposit occurs in the basement rocks of the Stuart Shelf geological province in the north of South Australia, west of Lake Torrens (BHP 2019a). The main copper-bearing minerals at Olympic dam are chalcopyrite, bornite and chalcocite (DEM 2019).
Surface extension	40.99km ² 40.99 km ² (Image date: 08.02.2020; Viewing height: 7.88 km) (Google Earth)
In operation since	1988 1988 (BHP 2018a)
Operator	BHP Billiton
Owner	BHP Billiton
Closest town	560 km north-west of Adelaide
Province	South Australia
Country	Australia
Longitude	136.8893617°
Latitude	-30.4403403°
Altitude	110 m a.s.l. 110 m a.s.l.
Main product and by-products	Main product: Copper concentrate; By-products: Gold, silver, uranium (BHP 2019a)

On-site processing stages	Olympic Dam is an underground mining operation with a fully integrated processing facility on the surface. The mined ore is hauled to the surface via an automated train system for further processing. The operation processes the ore in a fully integrated metallurgical complex consisting of a grinding and concentrating circuit, a hydrometallurgical plant with solvent extraction circuits for copper and uranium, as well as a copper smelter, a copper refinery and a circuit for the recovery of precious metals (BHP 2019a).
Annual production	136.7 kt of copper cathodes and 3,364 tons of uranium (payable metal in concentrate), 91,600 oz gold and 792,000 oz of silver in 2018 (BHP 2018a)
Proven Reserves	154 Mt and 8.4 Mt low grade (BHP 2018a)
Probable Reserves	346 Mt and 27 Mt low grade (BHP 2018a)

Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The mined ore is 100 % sulphide ore (BHP 2017a).	Since all the mined ore is sulphidic preconditions for Acid Mine Drainage are met, resulting in a high EHP for the indicator.	High	A = high, can be derived directly from available data
Paragenesis with heavy metals	Copper is itself a heavy metal. There is no information on paragenesis with other heavy metals.	The mined ore is mainly sulfidic, moreover copper is a chalcophile element. Overall preconditions for generating acid mine drainage are given. Accordingly, the environmental hazard potential resulting from AMD potential is high.	High	A = high, can be derived directly from available data

Paragenesis with radioactive components	In addition to copper, uranium is also mined.	The deposit shows uranium mineralization of commercial interest resulting in a high EHP due to paragenesis with radioactive components	High	A = high, can be derived directly from available data
Deposit size	Olympic Dam was opened in 1988 and at the current production capacity produced approximately 4.5 Mt of copper (Mining Technology 2019). The current proven reserves amount to 154 Mt of ore at a grade of 2.06 % Cu resulting in ca. 3 Mt of copper left in the deposit (BHP 2018a). Accordingly the deposit size amounts to ca. 7.5 Mt of copper.	The deposit size is large according to Petrow et al. 2008 (see Dehoust et al. 2017b). Larger deposits potentially have a greater expected total impact on the natural environment. Considering the estimated production and the remaining resources Olympic Dam's EHP resulting from the deposit size is high.	High	B1 = medium, can be estimated on the basis of available information
Ore grade	The average grade for the reserves is 2.06 % Cu (BHP 2018a).	According to Priester et al. (2019) copper grades between 0.5 and 3 % Cu are average grades. Accordingly, the EHP resulting from the specific 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	Underground mining (BHP 2018a)	Underground mining operations disturb a rather small surface area compared to	Low	A = high, can be derived directly

		other types of mining. Accordingly the EHP resulting from the mining method is low.		from available data
Use of auxiliary substances	Two grinding circuits with flotation to extract copper concentrate from sulphide ore. The copper concentrate is smelted and electro-refined to high-purity copper. After treatment by flotation, the finely-crushed ore is leached with sulphuric acid to dissolve uranium and any remaining copper. Waste generated during electro-refining are treated to recover gold and silver (Mining Technology 2019).	The process involves a flotation circuit where potentially toxic reagents are used. Therefore extraction and processing pose a high EHP.	High	C = low, no concrete information, no general specifications in the measuring instructions, (expert) estimate
Mining waste	Wet residues from on-site processing and the metallurgy plant are stored in 5 tailings storage facility cells. Totalling in a surface of 640 ha and dam heights ranging between 11 and 30 Meters. A number of further ponds are located on site for the storage of mine water, sewage and other wastes (BHP 2009, 2018b).	Various large tailings storage facilities and other ponds containing liquid wastes are located at the mining sites. Moreover the highest dam structures reach heights of 30 m qualifying them as Large Dams according to ICOLD (2011). Accordingly, the mining waste management poses a high EHP.	High	A = high, can be derived directly from available data
Remediation measures	A detailed remediation plan is in place that is updated regularly and also considers radiological aspects of the operation (BHP 2013).	There are detailed plans for mine closure in place. Where practical progressive rehabilitation measures will be 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). Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	The mine is located in an area with a medium EHP for earthquakes which determines the evaluation result. The other sub-indicators have a low 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 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 EHP for water stress is low but the mine is situated in a desert area with a high EHP. This results in an overall high EHP for the indicator.	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 site 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	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 2019)
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 (BHP 2018c)
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?	No information available No information available.
Responsible Copper (RC): Is the mine certified?	No information available No information available.
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?	Not applicable Not applicable
Responsible Steel (RS): Is the mine certified?	Not applicable Not applicable
Australian Steel Stewardship Forum (ASSF): Is the owner a member of the ASSF?	Not applicable Not applicable
Australian Steel Stewardship Forum: Is the mine certified?	Not applicable Not applicable
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (BHP 2017b)
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No (Australia) (BHP 2019b)
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 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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