

# ÖkoRess III

## Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

**Gove Operations Bauxite Mine**

**Rio Tinto , Australia**

ID: 84

## 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>

# Gove Operations Bauxite Mine

## Bauxite

General information 	
Indicator or criteria	Description and values
Name of mine	Gove Operations Bauxite Mine
Description of mining area	The Gove bauxite mining complex includes the open cut mine, the alumina refinery (closed down), residue disposal area, power station, port and ship loading facilities (Mining Atlas 2015). The mining area is located on the Gove Peninsula in a woodland area in the close proximity of the Arafura Sea (Google 2018) The mining lease covers an area of 205 km <sup>2</sup> with an average area of 130 ha mined each year (Northern Land Manager 2018).
Surface extension	162.14km <sup>2</sup> 162.14 km <sup>2</sup> (Image date: 16.07.2018; Viewing height: 12.91 km) (Google Earth)
In operation since	1970 1970
Operator	Rio Tinto
Owner	Rio Tinto
Closest town	Ca. 6 km west of Yirrkala; 14 km southeast of Nhulunbuy (Digital Atlas 2018)
Province	Northern Territory(Rio Tinto 2018)
Country	Australia
Longitude	136.837017°
Latitude	-12.261117°
Altitude	48 m a.s.l. About 48 m a.s.l. (Digital Atlas, 2018)
Main product and by-products	Bauxite (main commodity) (RioTinto 2017)

On-site processing stages	Mining to crushing and screening (Pacific Aluminium 2012). The board of Rio Tinto made the decision to permanently shut the Gove refinery in October 2017 (RioTinto 2018)
Annual production	12.54 Mt ( in 2018) (Rio Tinto, 2019)
Proven Reserves	138 Mt (Rio Tinto 2019)
Probable Reserves	3.8 Mt (Rio Tinto 2019)

## Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Aluminium, which is extracted from bauxite, is a lithophilic element. Lithophilic elements are usually extracted from oxide deposits. In general, AMD requires the presence of sulfide minerals (Dehoust et al. 2017).	The lithophilic elements show consistently low environmental hazard potential (EHP) for AMD.	Low	B2 = medium, classified according to measuring instructions
Paragenesis with heavy metals	Heavy metals, e.g., cadmium measured in the Gove harbor and near the processing plant (in sediments, water and oysters) have shown to exceed the limit recommended by the National Health and Medical Research Council (Peerzada et al. 1990). Aluminium ores are associated with the heavy metals, chrome, zinc and copper (Dehoust et al. 2017).	The extraction of metallic raw materials is usually associated with a certain level of heavy metal pollution. Moreover cadmium levels at Gove have been reported to exceed recommended limits. Accordingly the EHP for heavy metals is high.	High	B1 = medium, can be estimated on the basis of available information

<p>Paragenesis with radioactive components</p>	<p>An analysis of radioactive elements indicates that bauxite mined at Gove contains 2.5 ppm of uranium and 10 ppm of thorium (Sato et al. 2013)</p>	<p>Low levels of both thorium and uranium have been measured in the ore. The radiation is below threshold values of the measuring instructions that would prohibit a use as a building material (thorium 12 ppm / 49 ppm + uranium 2.5 ppm / 24 ppm is lower than 1). Accordingly, the EHP resulting from radioactive components is low.</p>	<p>Low</p>	<p>A = high, can be derived directly from available data</p>
<p>Deposit size</p>	<p>The mine started production in 1970. Calculating with an approximate annual production of 12 Mt and 37 years of production, up to day a total of ca. 444 Mt of Bauxite have been extracted. Total remaining reserves and resources at Gove are 142 Mt at 49.3% Al<sub>2</sub>O<sub>3</sub> (Rio Tinto 2019). In Total the deposit contains ca. 586 Mt of bauxite.</p>	<p>According to Petrow et al. (2008) the deposit is large. Larger deposits potentially have a greater expected total impact on the natural environment. Accordingly, Gove's EHP resulting from the deposit size is high.</p>	<p>High</p>	<p>A = high, can be derived directly from available data</p>
<p>Ore grade</p>	<p>49.3 % Al<sub>2</sub>O<sub>3</sub> (Rio Tinto 2019))</p>	<p>A grade and tonnage model from 2004 comparing bauxite mines indicates that the median grade of active bauxite mines is 45.6 % Al<sub>2</sub>O<sub>3</sub> (Meyer 2004). Since the grade at Gove is very close to this value and both significantly higher and lower grades have been reported, the EHP resulting from the ore grade is medium.</p>	<p>Medium</p>	<p>B1 = medium, can be estimated on the basis of available information</p>

Technology 				
Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Conventional open-pit mining methods are used to extract the bauxite (Rio Tinto 2018)	Open pit mining of sedimentary deposits disturbs large surface areas Therefore, the EHP resulting from the mining method is high.	Medium	B2 = medium, classified according to measurement instructions
Use of auxiliary substances	Only mechanical processes without additional substances are in place (Pacific Aluminium 2012). (The board of Rio Tinto made the decision to permanently shut the Gove refinery in October 2017 (RioTinto 2018).	In the past bauxite has been refined at the mine site. Since the refinery has been closed, only the currently involved processing methods are evaluated. No auxiliary substances are used accordingly the extraction and processing poses a low EHP.	Low	A = high, can be derived directly from available data
Mining waste	Bauxite residues from the refining process (in the past) were drystacked at the Residue Disposal Area. Wet residues from processing are stored in large tailings storage facilities (Pacific Aluminium 2012).	Large tailings storage facilities pose a High Environmental Hazard Potential.	High	A = high, can be derived directly from available data
Remediation measures	In the rehabilitation programme, seeds and plant species from mined areas are collected, catalogued and stored. The subsoil and topsoil over mined areas is replaced as soon as the bauxite has been removed. The topsoil is distributed over the prepared areas and the area is ribbed to improve quality. The area is	Process accompanying renaturation or recultivation leads to a low EHP.	Low	A = high, can be derived directly from available data

	then planted and fertilized immediately before the start of the rainy season (Northern Land Manager 2018, Pacific Aluminum 2012).			
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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.	GIS based evaluation of indicators. Detailed description on data basis and calculation rule can be found in the measuring instructions.	Low	B2 = medium, classified according to measuring 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.	GIS based evaluation of indicators. Detailed description on data basis and calculation rule can be found in the measuring instructions.	Low	B2 = medium, classified according to measuring 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 p. 20).	GIS based evaluation of indicators. Detailed description on data basis and calculation rule can be found in the measuring instructions.	Medium	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	No
International Agreements	
ILO 176	Not ratified

Others	OECD member since 1971
<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 &amp; 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 &amp; Rifici 2018).</p>
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## Corporate Social Responsibility (CSR)

<b>Voluntary Standards</b>	
<p>Aluminium Stewardship Initiative (ASI): Is the mine owning company a member?</p>	<p>Yes Yes (ASI 2018a)</p>
<p>Aluminium Stewardship Initiative (ASI): Is the mine certified?</p>	<p>Yes Yes (ASI 2018b)</p>
<p>International Council of Mining &amp; Metals (ICMM): Is the mine owning company a member?</p>	<p>Yes Yes (ICMM 2018)</p>
<p>Towards Sustainable Mining (TSM) Is the mine owning company a member of the Mining Association of Canada (MAC)?</p>	<p>Yes Yes (MAC 2018)</p>
<p>Towards Sustainable Mining (TSM) outside Canada: Are TSM standards implemented*?</p>	<p>No information available No mention of application of TSM protocols outside of Canada in the Sustainability Report (Rio Tinto 2018a)</p>

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“	0.570 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?	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
<b>ISO and CSR reporting</b>	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	Yes Yes (2005-2008) (Steward 2011, Rio Tinto 2014)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes (UK) (RioTinto 2018b)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (UK) (RioTinto 2018b)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information available
<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 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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- Öko-Institut e.V. (Institute for Applied Ecology)