

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Gole Gohar

Golgohar Mining & Industrial Co. , Iran

ID: 28

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>

Gole Gohar

Iron ore

General information	
Indicator or criteria	Description and values
Name of mine	Gole Gohar
Description of mining area	The mine is located in the Kerman province in Iran. The area is characterized by arid conditions. In the south west of the mine there is a mountain range. In Gole Gohar there are six ore bodies spread across an area of approximately 4 by 10 km (Lashgari et al. 2012).
Surface extension	79.36km ² 79.36 km ² (Image date: 23.12.2018; Viewing height: 12.31 km) (Google Earth)
In operation since	1974 1974 (Oraee / Goodarzi 2015)
Operator	Golgohar Mining & Industrial Co.
Owner	Golgohar Mining & Industrial Co.
Closest town	Sirjan, ca. 50 km north-west of the mine (Golgohar 2019a)
Province	Kerman Province
Country	Iran
Longitude	55.329861°
Latitude	29.093018°
Altitude	1750 m a.s.l. 1750 m a.s.l. (Google Earth)
Main product and by-products	Main product: Iron ore, concentrate and pellets; By-products: none (Golgohar 2019a)
On-site processing stages	Drilling, blasting, crushing, milling, magnetic separation (Hosseini / Samanipour 2015)




Annual production	Information not available from mine owner. Retrieved information ranging from 8 Mt (International Business Publications 2015) to 11 Mt (Oraee / Goodarzi 2015) [both probably referring to 2014 and iron ore] 9.1 Mt of Iron ore production in 2012 (Mesteel n.d.).
Proven Reserves	Varying estimations (deposit size): 275 Mt (International Business Publications 2015)
Probable Reserves	470 Mt (International Business Publications 2015)

Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Jahanshahi & Zare (2015) argue that due to a limited presence of sulphide minerals in combination with the presence of calcite in the area, any acid generated would be neutralized.	Sulphide minerals are present to limited extent also iron is a siderophile element. Accordingly the EHP for acid mine drainage is medium.	Medium	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	An analysis of both wet and dry tailings indicates that levels of the heavy metals Cr, Pb and V are elevated (Shahba et al. 2017). Another analysis comes to similar conclusion suggesting that the soils and plants near the mine are contaminated with potentially toxic elements (Soltani et al. 2017). A third study comes to the conclusion that water in the vicinity of the mine is only moderately contaminated despite exceeding WHO admissible concentrations for Aluminium (Al), Arsenic (As) and Manganese (Mn) (Jahanshahi / Zare 2015).	Independent scientific analysis of the mine waste shows that there are elevated heavy metal concentrations. Accordingly, the mine poses a high environmental hazard potential for the contamination with heavy metals.	High	A = high, can be derived directly from available data

Paragenesis with radioactive components	No information concerning the presence of radioactive components could be obtained.	In accordance with the measuring instructions, iron ore deposits are evaluated with a medium EHP, if no other information is available. This class division is based on average thorium and uranium activity levels in Chinese iron ore deposits (Dehoust et al. 2017b)	Medium	B2 = medium, classified according to measurement instructions
Deposit size	No information from the mine owner available. Estimations range from 745 Mt (International Business Publications 2015) to 1135 (Oraee / Goodarzi 2015) and up to 1200 Mt of total reserves (Pirmoradi 2017). Assuming a total reserve of approximately 1000 Mt at a grade of 57.2 % Fe. 572 Mt of iron remain in the deposit. The mine has been in operation since 1994 (Pirmoradi 2017). Therefore it has been in production for ca. 25 years; calculating with 8 Mt of annual iron ore production at a grade of 57.2 % Fe a total of ca. 114 Mt of iron have been mined. In total the deposit adds up to ca. 668 Mt of iron.	The deposit size is medium according to the measuring instructions. Larger deposits potentially have a greater expected total impact on the natural environment. Accordingly, Gole Gohar's EHP resulting from the deposit size is medium.	Medium	C = low, no concrete information, no general specifications in the measuring instructions
Ore grade	57.2 % Fe (Soltani et al. 2018)	No official documents (in English) published by the owner could be obtained. Priester et al. (2019) categorize iron ore with grades between 30 and 60 % as medium grade deposits. Accordingly, the environmental hazard potential caused by the ore grade at Gole Gohar is medium.	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	Open pit mining (underground mining is planned) (Golgohar 2019b).	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 iron ore is extracted by drilling and blasting. Afterwards the ore is transported by mining trucks to the processing plant. The ore is crushed in a primary gyratory crusher. After primary crushing, ore is milled and transferred to a dry low intensity magnetic separator (LIMS). A part of this step is already the finished concentrate some of the output is tailings and the fraction in between is processed further by regrinding in a wet mill process producing the iron concentrate in a wet low intensity magnetic separator (Hosseini / Samanipour 2015)	The extraction and processing involves steps that require the use of auxiliaries. At Gole Gohar blasting involves the use of explosives. Accordingly the EHP resulting from extraction and processing is low.	Medium	B1 = medium, can be estimated on the basis of available information
Mining waste	There are a number of mine waste dumps and at least one Tailings Storage Facility (TSF). The TSF was commissioned in 2011 and the dam is earth filled with a clay core. The length of the	According to the definition of the ICOLD (2011) Tailings Storage Facilities fulfils the requirements of a large dam. Accordingly the EHP resulting from waste management is high.	High	A = high, can be derived directly from available data

	dam is 795 m and 25 m of height (Geosense 2018).			
Remediation measures	No information concerning remediation measures could be obtained.	WGI indicators for Iran rank among the lowest. It can be assumed that generally authorities have a low probability of scrutinizing mines properly. In consequence, it is assumed that companies may not put as much effort into remediation as they would in a country with stricter control. This might even be amplified by the fact that the mine owner is a state owned company.	High	C = low, no concrete information, no general specifications in the measuring instructions, (expert) estimate

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 EHP for earthquakes is high which determines the evaluation result although the EHP for the other sub-indicators is low.	High	B2 = medium, classified according to measurement 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	The EHP for water stress is high and the mine is situated in a desert area. Both results alone already determine the high EHP result.	High	B2 = medium, classified according to

	supplemented by desert areas. The highest hazard level of the sub-indicators determines the total result.			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).	The mine is situated in a protected area which determines a medium EHP.	Medium	B2 = medium, classified according to measurement instructions

State Governance

Indicators	
WGI 1 -Voice and Accountability	12.81 ^{ooo}
WGI 2 -Political Stability and Absence of Violence/ Terrorism	15.71 ^{ooo}
WGI 3 - Government Effectiveness	45.19 ^{ooo}
WGI 4 -Regulatory Quality	10.1 ^{ooo}
WGI 5 - Rule of Law	25.96 ^{ooo}
WGI 6 -Control of Corruption	20.19 ^{ooo}

EPI (Environmental Performance Index)	58.16
EITI membership	No
International Agreements	
ILO 176	Not ratified
Others	No information obtained
Legal framework	

<p>Areas of Law: Environment</p>	<p>The Mining Law dates back to 17 May 1998. The original Act has been amended in 2011. The Ministry of Industry, Mine and Trade is responsible for issuing mining licenses (Ghaffari 2013; Nateq-Nouri 2018). Holders of mining licenses aiming at “optimal exploitation and conservation of mineral deposits by enhancing productivity, research, development and exploration and preservation of environment in their mines” can save up to twenty percent (20 %) from payment of royalties (Islamic Republic Iran, Ministry of Industry, Mine and Trade 2011).</p> <p>There is an Environmental Protection Law in place which dates back to 1974 and identifies four categories of protected natural areas: national parks, wildlife refuges, protected areas, and national nature monument (Wagner n.d.).</p> <p>IMIDRO (Iranian Mines & Mining Industries Development & Renovation) is responsible for the implementation of the mining framework and often serves as a joint venture partner, particularly for large mining projects (Al Barazi et al. 2016).</p> <p>No information concerning mine closure, rehabilitation or public consultations could be obtained or has been mentioned in the translated Mining Act (Islamic Republic Iran, Ministry of Industry, Mine and Trade 2011).</p>
<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>Occupational Health and Safety is regulated by the Labour Law of 1990. Mining is not addressed specifically. Employers are required to address health and safety issues. The requirements are inspected by the Ministry of Health, the Ministry of Labour and the national insurance organization (Ghaffari 2013).</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?	No No (ICMM 2019)
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 2018)
Responsible Mining Index Company indicator „Working conditions“	Not applicable Not applicable (RMI 2018)

Responsible Mining Index Company indicator „Environmental sustainability“	Not applicable Not applicable (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 2019)
Australian Steel Stewardship Forum: Is the mine certified?	No No (ASSF 2019)
ISO and CSR reporting	
ISO 14001 (ISO 14004): Is the mine ISO 14001 certified?	No No
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No
OECD Guidelines: Does the company have its headquarters in a signatory state?	No No (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	No No
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

- Al Barazi, S.; Andruleit, H.; Babies; Meßner, J.; Roth, F.-M.; Schauer, M.; Schmidt, S.; Schulz, S.-U. (2016): Iran - Ein Rohstoffwirtschaftlicher Sachstand. Commodity TopNews Bundesanstalt für Geowissenschaften und Rohstoffe (BGR).
https://www.bgr.bund.de/DE/Gemeinsames/Produkte/Downloads/Commodity_Top_News/Rohstoffwirtschaft/49_iran.pdf?__blob=publicationFile&v=2 (29.05.2020).
- ASSF (2019): Membership. In: Australian Steel Stewardship Forum (ASSF). <http://steelstewardship.com/membership/>. (01.11.2019).
- Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017a): Erörterung ökologischer Grenzen der Primärrohstoffgewinnung und Entwicklung einer Methode zur Bewertung der ökologischen Rohstoffverfügbarkeit zur Weiterentwicklung des Kritikalitätskonzeptes (ökoRes I) - Konzeptband. Umweltbundesamt, Dessau-Roßlau.
- Dehoust, G.; Manhart, A.; Möck, A.; Kießling, L.; Vogt, R.; Kämper, C.; Giegrich, J.; Auberger, A.; Priester, M.; Rechlin, A.; Dolega, P. (2017b): Erörterung ökologischer Grenzen der Primärrohstoffgewinnung und Entwicklung einer Methode zur Bewertung der ökologischen Rohstoffverfügbarkeit zur Weiterentwicklung des Kritikalitätskonzeptes (ökoRes I) - Methode für einen standortbezogenen Ansatz. Umweltbundesamt, Dessau-Roßlau.
- EITI (2019): EITI Countries. In: Extractive Industries Transparency Initiative. <https://eiti.org/countries>. (16.04.2019).
- Geosense (2018): Golgohar Tailing Dam, Iran. Geosense - Dam Safety Monitoring.
- Ghaffari, M. (2013): Safety and health in mining in I.R. Iran. In: K. ELGSTRAND: / E. VINGÅRD: Occupational Safety and Health in Mining Anthology on the situation in 16 mining countries. Gothenburg.
- Golgohar (2019a): Golgohar At a Glance. In: Golgohar Mining & Industrial Co.
<http://www.geg.ir/index.aspx?siteid=3&fkeyid=&siteid=3&fkeyid=&siteid=3&pageid=270>. (29.05.2020).
- Golgohar (2019b): Golgohar's Road to Internationalization. In: Golgohar Mining & Industrial Co.
<http://en.geg.ir/index.aspx?fkeyid=&siteid=3&pageid=267>. (29.05.2020).
- Hosseini, H.; Samanipour, M. (2015): Prediction of Final Concentrate Grade Using Artificial Neural Networks from Gol-E-Gohar Iron Ore Plant. In: American Journal of Mining and Metallurgy. Vol. Vol. 3, S. 58-62.

- ICMM (2019): Member companies. In: International Council on Mining and Metals (ICMM). <https://www.icmm.com/en-gb/members/member-companies>. (16.04.2019).
- ICOLD (2011): Constitution Status. International commission on large dams (ICOLD). https://www.icold-cigb.org/userfiles/files/CIGB/INSTITUTIONAL_FILES/Constitution2011.pdf (13.05.2020).
- International Business Publications (2015): Iran – Mineral, mining sector investment and business guides. Strategic information and regulation Washington, DC.
- IRMA (2014): Standard for Responsible Mining. Draft v1.0. Initiative for Responsible Mining Assurance (IRMA). https://responsiblemining.net/wp-content/uploads/2018/09/IRMA_Standard_Draft_v1.007-14.pdf.
- IRMA (2018): Responsible Mining Map. In: Initiative for Responsible Mining Assurance (IRMA). <https://map.responsiblemining.net/>. (16.04.2019).
- Islamic Republic Iran (2011): Iran Mining Act. Ministry of Industry, Mine and Trade. <http://espeer.ir/files/pdf/IranMiningAct.pdf> (29.05.2020).
- Jahanshahi, R.; Zare, M. (2015): Assessment of heavy metals pollution in groundwater of Golgohar iron ore mine area, Iran. In: Environ Earth Sci. No.74, S. 505–520.
- Lashgari, A.; Yazdani-Chamzini, A.; Fouladgar, M. M.; Zavadskas, E. K.; Shafiee, S.; Abbate, N. (2012): Equipment Selection Using Fuzzy Multi Criteria Decision Making Model: Key Study of Gol-e-Gohar Iron Mine. In: Engineering Economics. Vol. 23, S. 125–136.
- MAC (2019): Our Members. In: The Mining Association of Canada (MAC). <http://mining.ca/members-partners/our-members>. (16.04.2019).
- Mesteel (n.d.): Gol-E-Gohar, Iran, Iron Ore Resources.
- Nateq-Nouri, A. A. (2018): Mining Law of Islamic Republic of Iran. In: Farama & Co. <http://faramalaw.com/laws19.html>. (29.05.2020).
- OECD (2019): Member Countries. In: Organisation for Economic Co-operation and Development (OECD). <https://www.oecd.org/about/members-and-partners/>. (05.11.2019).
- Oraee, K.; Goodarzi, A. (2015): Feasibility study of Gol-Gohar iron ore open cast mine operation of Iran.
- Pfister, S.; Koehler, A.; Hellweg, S. (2009): Assessing the Environmental Impacts of Freshwater Consumption in LCA. In: Environmental science & technology. Vol. 43, No.11, S. 4098–4104.
- Pirmoradi, S. (2017): Sirjan Iron Ore Complex. In: Iran International Magazine. No.83.
- Priester, M.; Ericsson, M.; Dolega, P.; Löf, O. (2019): Mineral Grades: An important indicator for environmental impact of mineral exploitation. In: Mineral Economics. Raw Materials Report. Springer Nature Vol. 32, No.2, S. 127–256.
- RMI (2018): Companies. In: Responsible Mining Index (RMI). </en/companies/29>. (16.04.2019).
- Shahba, S.; Arjmandi, R.; Monavary, M.; Ghodusi, J. (2017): Iron ore waste classification according to UNEP guidelines (case study: Golgohar mining and industrial complex in Sirjan, Iran). In: Applied Ecology and Environmental Research. Vol. 15, No.4, S. 943–956.

Soltani, N.; Keshavarzi, B.; Moore, F.; Sorooshian, A.; Ahmadi, M. R. (2017): Distribution of potentially toxic elements (PTEs) in tailings, soils, and plants around Gol-E-Gohar iron mine, a case study in Iran. In: Environmental Science and Pollution Research International. Vol. 24, No.23, S. 18798–18816.

Soltani, N.; Keshavarzi, B.; Sorooshian, A.; Moore, F.; Dunster, C.; Dominguez, A. O.; Kelly, F. J.; Dhakal, P.; Ahmadi, M. R.; Asadi, S. (2018): Oxidative potential (OP) and mineralogy of iron ore particulate matter at the Gol-E-Gohar Mining and Industrial Facility (Iran). In: Environmental Geochemistry and Health. Vol. 40, No.5, S. 1785–1802.

Wagner, B. (n.d.): Iran: Global Environmental Law.

Wendling, Z. A.; Emerson, J. W.; de Sherbinin, A.; Esty, D. C. (2020): 2020 Environmental Performance Index. Yale Center for Environmental Law & Policy, New Haven, CT. <https://epi.yale.edu/epi-results/2020/component/epi> (11.08.2020).

WGI (2019): The Worldwide Governance Indicators (WGI). The World Bank. <http://info.worldbank.org/governance/WGI/#home>. (10.12.2018).

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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