ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Mikhailovsky

Metalloinvest , Russia

ID: 20

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.

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[1]TEXTE 87/2017 https://www.umweltbundesamt.de/publikationen/discussion-of-the-environmental-limits-of-primary

Mikhailovsky

Iron ore

General information	
Indicator or criteria	**Description and values**
Name of mine	Mikhailovsky
Description of mining area	The Mikhailovsky mine is located near Zheleznogorsk, 100 km NW of Kursk. The operator (Mikhailovsky GOK) develops the deposit, which is located in one of the world's largest iron ore basins. The Kursk Magnetic Anomaly mainly consists of magnetic ore with an average iron level of 34–39 %. The mineralised Mikhailovsk Series, which is up to 3,000 m thick, rests unconformably on Archaean basement (as described previously) and consists mainly of amphibolites with subordinate quartzites and metasandstones, talc-carbonate rocks, meta-dolerites and serpentinites. At Mikhailovsk, the overlying Kursk Series comprises the 500 to 1000 m thick lower sand-shale group; the 500 to 600 m thick middle iron-ore group, containing specularite-magnetite, magnetite, and lean-ore quartzites; and the upper 700 m thick group of quartz-sericite phyllitic and carbonaceous slates with seams of dolomite. The Mikhailovsk deposit is restricted to a large block of ferruginous quartzites on the western limb of the Mikhailovsk Syncline where the quartzite layers have been deformed into a series of folds with steep 60-80°E dipping axial planes (Porter GeoConsultancy n.d.). The Mikhailovsky open pit is 6.0 km x 2.9 km wide and >205 m deep.
Surface extension	99.38km² 99.38 km2 (Image date: 23.11.2019; Viewing height: 15.96 km) (Google Earth)
In operation since	1957 1957
Operator	JSC Holding Company Metalloinvest
Owner	Metalloinvest
Closest town	Zheleznogorsk, 2-3 km from open pit (GoogleEarth 2019)
Province	Kursk Province (GoogleEarth 2019)

Country	Russia
Longitude	35.480889°
Latitude	52.334306°
Altitude	200 m a.s.l. 200 m a.s.l. at the plant site (GoogleEarth 2019)
Main product and by-products	Main product: Iron (Fe); by-products: None "Metalloinvest is an integrated metals and mining company covering all stages of the production chain to supply customers … with high-quality iron ore, metallised and rolled steel products" (Metalloinvest 2018).
On-site processing stages	The Company is a global-scale producer of beneficiated iron ore products, processing the majority of its primary iron ore concentrate products into high added-value products, such as iron ore pellets and HBI/DRI. In 2016, Metalloinvest accounted for 39 % of Russia's iron ore concentrate and sintering ore output, 59 % of iron ore pellets and 100 % of HBI and metallized pellets (Metalloinvest 2019a). The mine has a beneficiation plant and 3 pellet plants. MGOK's pellet plant number 3 was commissioned in September 2015 bringing total pellet capacity to 15 Mtpa. Crushing and beneficiation plants can now handle more than 17 Mt of concentrate and the company has launched fine screening to increase the quality of merchant iron ore concentrate from 65 % Fe to 67 % Fe (Wood Mackenzie 2018). Sintered ore, Iron ore concentrate, Non-fluxed pellets, Fluxed pellets (Metalloinvest 2018).
Annual production	Sintered ore 1,709 kt, concentrate 16,781 kt, pellets 14,888 kt (Metalloinvest 2019b)
Proven Reserves	"14.1 billion tonnes of proven and probable reserves on a JORC (IMC Montan) equivalent basis and about 140 years of reserve life" (Metalloinvest 2019c).
Probable Reserves	"14.1 billion tonnes of proven and probable reserves on a JORC (IMC Montan) equivalent basis and about 140 years of reserve life" (Metalloinvest 2019c).

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality

Preconditions for acid mine drainage (AMD)	The compact enriched ores contain 45 to 46.4 % Fe; 0.7 to 0.9 % Sulphur (S); 0.06 to 0.08 % Phosphorus (P); while the friable enriched ores contain 52 to 58.5 % Fe; 0.24 to 0.32 % S; and 0.03 to 0.05 % P (Porter GeoConsultancy n.d.).	According to the Goldschmidt-Classification, iron is a siderophile element. Sulphur content for the Mikhailovsky ore is reported as low (under 1.0 %) indicating low preconditions for AMD. Based on the measuring instructions for siderophile elements and considering the low AMD potential, the Environmental Hazard Potential (EHP) is evaluated as low.	Low	A = high, can be derived directly from available data
Paragenesis with heavy metals	No paragenesis of heavy metals in ore could be determined.	In cases when no paragenesis of heavy metals in ore could be determined, the measurement instructions indicate a medium EHP.	Medium	B2 = medium, classified according to measurement instructions
Paragenesis with radioactive components	No indication of paragenesis with thorium (Th) and uranium (U) in iron ore could be determined.	In accordance with the measurement instructions, iron ore deposits are usually evaluated with a medium EHP, if no other information is available.	Medium	B2 = medium, classified according to measurement instructions
Deposit size	Mikhailovsky (2012): 10.7 Gt of ore (Porter GeoConsultancy 2019)	The deposit size (assuming 4.2 Gt @ 36 % Fe = 3.85 Gt of Fe metal content) is significantly larger than 10 billion t and is therefore classified as gigantic, even without calculating the extracted ore since 1957. According to measurement instructions based on Petrow et al. (2008, In: Dehoust et al. 2017b), this results in a high EHP as gigantic deposits have a potentially higher expected total impact on the natural environment.	High	A = high, can be derived directly from available data

Ore grade	Iron 34–39 %	The medium grade (Fe 34-39 %) deposit of predominantly magnetite quartzite ore indicates a medium EHP according to measurement instructions based on Priester et al. (2019).	Medium	A = high, can be derived directly from available data

Technology

Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
Mine type	Hard rock open-pit mining using drill & blast, excavators and haul trucks	Conventional solid rock open pit mining is evaluated with a medium EHP. During open pit mining in solid rocks, the mining activities are restricted to the horizontal and vertical extension of the ore body/mineralized zone. The impact is higher than in underground mining but less pronounced then in mining of alluvial or unconsolidated sediments	Medium	A = high, can be derived directly from available data
Use of auxiliary substances	Ore extraction is carried out with trucks and shovels after drilling and blasting. The ore material is hauled to the reloading stations located in lower and mid-level pit benches where it's reloaded into the dump cars, then transported to the crusher and from there to the beneficiation plant. The magnetite quartzite ore material is hard and goes through on-site primary crushing.	Ore processing is restricted to crushing, sorting and magnetic separation methods, thus allowing classification to low EPH.	Low	B1 = medium, can be estimated on the basis of available information

	Beneficiation is carried out on-site at refinery facilities that include crushing and sorting to produce sintered ore; beneficiation and pelletization to produce non-fluxed pellets; flotation to produce fluxed pellets (flotation and magnetic beneficiation since 2006) (Metalloinvest 2018).			
Mining waste	MGOK has constructed a recycled water supply system to eliminate wastewater discharges into the Ryasnik River. In 2017, the generated mining waste and tailings were reduced by 0.8 % vs. 2016 and totaled 128.1 Mt (75% on-site storage of tailings and waste rock). Most of the industrial waste is generated from the iron ore mining and extraction, as well as during the metallurgical operations: waste rock, overburden, tailings, slurry, ash-based waste, low quality raw materials, steel mill and furnace, iron-containing slimes (Metalloinvest 2019d).	Waste management plans are in place and selective dumping of waste is implemented, therefore, a low EHP is indicated.	Low	B1 = medium, can be estimated on the basis of available information
Remediation measures	Mikhailovsky GOK is undertaking major works to protect air quality. Dust suppression measures are taking place at the tailings disposal area, dust and gas cleaning systems are being refurbished at the factories, and roads are irrigated within the open pit. According to the enterprise's production control data, Mikhailovsky GOK's atmospheric emissions were 38.5 % lower than maximum permissible rates. 98 % of the generated waste has no environmental impact and is classified as	Remediation and reclamation plans are in place. Existing monitoring and rehabilitation plans would usually indicate a low EHP; however, a medium EHP is given for industrial mining companies in countries with less stringent law enforcement.	Medium	A = high, can be derived directly from available data

	Category V of Hazard (practically non-hazardous waste) (Metalloinvest 2019d)			

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 Michailovsky mining complex is located in an area with a medium EHP for floods (rated 2) which determines the evaluation result. The other sub-indicators have a low EHP.	Medium	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 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 water stress for the Michailovsky mining complex is low and it is not situated in a desert area, which results in a low EHP.	Low	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 2018).	The Michailovsky mining complex is not situated in or near 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	19.21 °°°
WGI 2 -Political Stability and Absence of Violence/ Terrorism	29.05 °°°
WGI 3 - Government Effectiveness	50.96 °°°
WGI 4 -Regulatory Quality	31.73 °°°
WGI 5 - Rule of Law	20.67 °°°
WGI 6 -Control of Corruption	21.15 °°°
EPI (Environmental Performance Index)	63.79
EITI membership	No
International Agreements	

ILO 176	The Russian Federation has ratified the ILO Safety and Health in Mines Convention, 1995 (No. 176)
Others	Signatory to the Minamata Convention 2013, signed on 24/09/2014, ratification still pending (UNEP 2019). Paris Agreement on Climate Change, adopted in Paris, France, under the United Nations Framework Convention on Climate Change. Signed by the Russian Federation on 22 Apr 2016, Acceptance on 7 Oct 2019 (UNFCCC 2016).

Legal framework

Areas of Law: Environment	The state body "Rosprirodnadzor" (The Federal Supervisory Service for Nature Management) exercises control and supervision to the mining operations plan, following the Environmental legislation (Josefson / Rotar 2018). Further approvals concerning deterioration of environmental media (e.g. air quality) are obtained by other legal offices. Public consultation is not mentioned. The mining operations plan has to consider all measures identified by the environmental impact assessment that is carried out at the Federal level. This addresses in particular storage of tailings, waste products, sanitary and epidemiological welfare. In case of closure of the mine site openings and drilled holes should be brought back into a condition guaranteeing life, health and safety of the environment and manmade infrastructure. The plan of mining operations must consider obligations and provisions of the zoning legislation (Posashkov / Mazurov 2018). However, deposits and occurrences of minerals are referred to as industrial zones.

Areas of Law: Occupational Health and Safety (OHS)	The main requirements for compliance with health and safety regulations applicable to mining operations are the same as those generally applicable for operating hazardous industrial facilities. Virtually all major aspects of mining operations are considered by Russian law to be hazardous industrial operations and are, therefore, regulated by Federal Law "On Industrial Safety at Hazardous Industrial Facilities" (Josefson / Rotar 2018). The law stipulates obligations in relation to occupational safety for both employers and employees. Violations to occupational safety requirements entail administrative and criminal sanctions according to the Criminal Code of the Russian Federation and the Administrative Offences Code (Posashkov / Mazurov 2018).

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 information available No information available
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
Responsible Mining Index Company indicator „Environmental sustainability"	Not applicable Not applicable
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 2019)
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 "Mikhailovsky GOK (part of Metalloinvest) confirmed compliance of its integrated management systems with international standards of quality,

	occupational health and safety, and environmental protection" (Metalloinvest 2013).
CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	No No, Metalloinvest is registered under Rublevskoye shosse Building 28 Moscow, 121609 Russian Federation (Metalloinvest 2019e)
OECD Guidelines: Does the company have its headquarters in a signatory state?	No No (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	Not exactly: "Metalloinvest's Sustainable Development Report is prepared based on the international standards of the Global Reporting Initiative (GRI) and ISO:26000 and with consideration of international best practice." The company has joined the UN Global Compact (UNGC) initiative (Metalloinvest 2019f). Not exactly: "Metalloinvest's Sustainable Development Report is prepared based on the international standards of the Global Reporting Initiative (GRI) and ISO:26000 and with consideration of international best practice." The company has joined the UN Global Compact (UNGC) initiative (Metalloinvest 2019f).

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