ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Lebedinsky

Metalloinvest , Russia

ID: 15

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

Lebedinsky

Iron ore

General information

Indicator or criteria	Description and values
Name of mine	Lebedinsky
Description of mining area	Lebedinsky is the largest iron ore mine in Russia and is located near the town of Gubkin (Belgorod Oblast), about 650 km south of Moscow. It is 100 % owned by Russian steelmaker Metalloinvest and is the only hot briquetted iron (HBI) producer in Russia (Metalloinvest 2018). The mine is the main supplier of iron products to the steel mills operating in Uralsk (Group's subsidiary), Oskol (Group's subsidiary) and Magnitogorsk. It has around 130 on-site primary and ancillary operational facilities (ibid.). Lebedinsky GOK (LGOK) 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 %. Within the mine area, Archaean basement is overlain by Mikhailovsk Kursk Series rocks. The iron formation within the Kursk Series is around 70 m thick, but has been complexly and tightly folded to form a thicker, more compact deposit in the area of the open pit. The mine used to exploit supergene enriched ores averaging 68.5% Fe with very low phosphor and sulphur content, but is now largely enriches low grade hypogene ore (Porter GeoConsultancy n.d.). In the immediate vicinity of the mine (1 km from industrial facilities), there is the nature reserve "Yamskaya Steppe", part of the wilderness area "Belogorye". Its unique steppe landscapes are partly degraded due to local rise of ground water levels in the gullies next to the tailings. A substantial part of the territory (more than 5 % within a 20 km zone of potential impacts) is occupied by quarries, tailings dumps, industrial sites and general transport infrastructure (Drozdova et al. 2016 p. 376). The first shop for the production of sponge iron reached its design capacity in 2001. The second shop was launched in 2007. Construction and assembly work started in 2014 on the third shop with a capacity of up to 1.8 million tonnes a year (President of Russia 2017).
Surface extension	71.19km^2 71.19 km2 (Image date: 15.10.2019; Viewing height: 14.65 km) (Google Earth)

In operation since	1967 1967: "The crude ore supplies base of the Plant is the two nearby deposits of ferruginous quartzite with the low iron content, mined with a single open pit. In 1964–1966, the processing technology was developed for this kind of ore, and construction of a mining and processing plant and an open pit mine was launched in 1967" (Alferiev et al. 2017).
Operator	JSC Holding Company Metalloinvest
Owner	Metalloinvest
Closest town	Gubkin (GoogleEarth 2019)
Province	Belgorodsky Province (GoogleEarth 2019)
Country	Russia
Longitude	37.633228°
Latitude	51.251786°
Altitude	230 m a.s.l. 230 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 Hot Briquetted Iron/Direct Reduced Iron (HBI/DRI). In 2015 Metalloinvest's share on the Russian market accounted for 37 % for iron ore concentrate and sintering ore, 58 % for pellets and 100 % for HBI/DRI. The Company is also a leading regional producer of niche steel products and produced approximately 7 % of Russian crude steel (Metalloinvest 2018). "Metalloinvest's HBI-3 plant at Lebedinsky GOK was launched in July 2017 and has boosted the company's HBI production capacity to 4.6 Mtpa." (Wood Mackenzie 2018) Beneficiation – Concentration - Secondary beneficiation - Non-fluxed pellets - after the first beneficiation goes to pelletization to produce iron pellets - after pelletization to HBI plant to produce Hot-Briquetted Iron
Annual production	Iron ore production volumes decreased by 1.8 % year-to-year and totalled 19.7 Mt following scheduled maintenance works and changes in ore quality (Metalloinvest 2019a). Lebedinsky annual production 2018: Concentrate 21.868 kt, pellets 8.792 kt, HBI 4,602 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" (Bloomberg 2019).
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" (Bloomberg 2019).

Geology

Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The Lebedinsky deposit type within the Kursk Magnetic Anomaly (KMA) is a hypogene magnetite quarzite deposit. Within the KMA, hypogene ferruginous quartzites cover an area of 14.8 km2 and contain 37.5 to 39 % Fe; 40 to 42 % SiO2; 0.01 to 0.07 % S (Sulphur) and 0.01 to 0.06 % P (Phosphor) (Porter GeoConsultancy n.d.).	According to the Goldschmidt-Classification, iron is a siderophile element. Sulphur content for the KMA is reported as minimal (under 0.1 %) indicating very low preconditions for AMD. Based on the measuring instructions for siderophile elements and considering the very low AMD potential, the Environmental Hazard Potential (EHP) is evaluated as low.	Low	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	The content of cobalt, nickel, chromium, vanadium, etc. [in groundwater] is 100 times the natural background in some places (Bugaeva et al. 2016 p. 370).	Presence of chromium in groundwater has been detected; however no paragenesis of heavy metals in ore could be determined, therefore, 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. However, traces of radioactive particles (aerosols) were detected in air samples (Bugaeva et al. 2016 p. 370).“The calculations based on the content of [radioactive elements] in the seepage of the tailings showed that 4 tons of uranium and 35 tons of thorium are removed from the tailings of LGOK … into the water system of the region annually” (Kotenko et al. 2003).	In accordance with the measurement instructions, iron ore deposits are usually evaluated with a medium EHP, if no other information is available. However, there are reports of Uranium and Thorium contamination in air and groundwater samples, therefore, a high EHP is indicated.	High	B2 = medium, classified according to measurement instructions
Deposit size	Lebedinsky (2012): 4.2 Giga tonnes (Gt) of ore (Porter GeoConsultancy 2019)	The deposit size (assuming 4.2 Gt @ 36 % Fe = 1.51 Gt of Fe metal content) is significantly larger than 10 Mrd. t and is therefore classified as gigantic, even without calculating the extracted ore since 1967. According to measurement instructions based on Petrow et al. (2008, cited 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 average 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. Beneficiation process occurs at on-site refinery facilities that include beneficiation for concentrate production; secondary beneficiation for non-fluxed pellet production; after the first beneficiation goes to pelletization and afterwards to the HBI plant. The magnetite quartzite ore material is hard and goes through on-site primary crushing. In-pit crushing and conveying system is being	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

	installed by German TAKRAF (Tenova Group) since 2018 and planned for commissioning in 2020 (Metalloinvest 2018)			
Mining waste	Volume of waste dumps and tailings storage facilities exceeds 1.5 billion m3. Valleys and ravines surrounding the mine are filled with waste rock and tailings. Waste dumps have a height of 60-100 m (Zektser et al. 2006). The company pays significant attention to the responsible use of land and mineral resources and reducing waste from mine production. 98 % of the generated waste has no environmental impact and is classified as Category III-V of Hazard (practically non-hazardous waste). 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) (Metalloinvest 2019c).	Waste management plans are in place and selective dumping of waste is implemented, however, waste deposition occurs in a fragile environment affecting air and groundwater, therefore, a medium EHP is indicated.	Medium	B1 = medium, can be estimated on the basis of available information
Remediation measures	On-going remediation efforts include, among others: • Reclamation of the TSF covering the area of 15.8 ha; • Acacia and grass planting in the loose overburden dump and TSF for minimizing dust producing surfaces over an area of 40 ha. The mine is conducting dust control activities to strengthen dusty surfaces and help with sanitary and hygienic reclamation of tailings dam levees and biological reclamation of loose overburden dump, such as hydro-coating of the TSF ponds using a clay and sand cover	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

	over an area of 300 ha. (Metalloinvest 2019c). In 2018, the atmospheric contaminant emissions increased by 3.14 % due to the production rise, but due to dust control measures, the Company was able to reduce the dust generation. (Metalloinvest 2019c).			

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. Metrics are directly taken from the given risk assessment. The indicator total is determined by the highest hazard level of the sub-indicators.	The Lebedinsky 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	A = high, can be derived directly from available data
Water Stress Index (WSI) und desert areas	The WSI by Pfister et al. 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 EHP for water stress is low (10-20 %) according to Pfister et al. (2009) and the mining complex is not situated in a desert area. Accordingly, the general result is 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	The mine is located in the vicinity (1 km from the industrial facilities) of the nature reserve "Yamskaya Steppe", part of the wilderness area "Belogorye", a protected area as defined in the ÖkoRess evaluation	Medium	A = high, can be derived directly from available data

	Initiative for Responsible Mining Assurance (IRMA 2018).	method, therefore, a medium EHP is indicated.		

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) on 19 Jul 2013 (Ratifications of ILO Conventions n.y.).
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 "Lebedinsky GOK (part of Metalloinvest) has passed an inspection audit of its environmental management system (EMS) in line with the requirements of the GOST R ISO 14001-2007 and MS ISO 14001:2004 standards" (Metalloinvest 2015)
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 2019d).
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 2019e). 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 2019e).
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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