

# ÖkoRess III

## Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

**Severny**

**PJSC ArcelorMittal Kryvyi Rih , Ukraine**

ID: 25

## 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>

# Severny

## Iron ore

General information 	
Indicator or criteria	Description and values
Name of mine	Severny
Description of mining area	ArcelorMittal Kryvyi Rih (AMKR) operates a concentrating facility, along with two open pit sites and one underground mine. The iron ore deposits are located within the southern part of the Krivorozhsky or Krywbas iron-ore basin the most important iron-ore region of eastern Europe (ArcelorMittal 2017). Kryvyi Rih as the center of Kryvyi Rih iron ore basin, is the major raw-material base of metallurgy of Ukraine (Ukraine Municipal Local Economic Development n.d.). Currently, iron ore is mined by a combination of open-pit and underground methods. The movement of rock layers affected by underground mining is not yet complete, cavities are still developing (Babets, Ye. 2015). The site is built as an fully integrated mining and metallurgy plant with e.g. mines, ore processing facilities, coke processing and metal-working (ArcelorMittal 2017).
Surface extension	26.49km <sup>2</sup> 26.49km <sup>2</sup> (Image date: 01.8.2018; Viewing height: 3.04 km) (Google Earth)
In operation since	1933 Open pit since 1959, underground mine since 1933 (ArcelorMittal 2017).
Operator	PJSC ArcelorMittal Kryvyi Rih
Owner	PJSC ArcelorMittal Kryvyi Rih
Closest town	Kryvyi Rih or Kriwoi Rog (population 660,000)
Province	Oblast Dnipropetrowsk
Country	Ukraine
Longitude	33.377371°

Latitude	47.929389°
Altitude	50 m a.s.l. Approx. -90 to 50 m a.s.l. (Google Earth)
Main product and by-products	Main product: iron ore; by-product: none
On-site processing stages	The structure of mining and processing includes two subdivisions: Mining and Transport (Mine Administration, Crushing Plants 3, 4, Mining Transport Shop) and Crushing and Processing (Crushing Plant, Ore Beneficiation Plants 1, 2, Slime Handling Shop) (ArcelorMittal n.d.)
Annual production	Run of Mine 2017 in total 22 Mt Crude ore. Extraction from open pit mining is 21.2 Mt, extraction from underground mining 0.8 Mt. (ArcelorMittal 2017)
Proven Reserves	In 2017, total of 83 Mt iron ore reserves. Open pit: 73 Mt (33.8 % Fe) Underground: 10 Mt (54.4 % Fe) (ArcelorMittal 2017)
Probable Reserves	In 2017, total of 97 Mt iron ore reserves. Open pit: 78 Mt (33.5 % Fe) Underground: 19 Mt (54.4 % Fe) (ArcelorMittal 2017)

## Geology



Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	The underground mine is basically a hematite ore. But no specific information an AMD could be obtained.	Iron ores are usually present in oxidic minerals, whereby the respective general association (including accompanying minerals) can often contain sulfides. In these cases, a medium rating is recommended.	Medium	B1 = medium, can be estimated on the basis of available information
Paragenesis with heavy metals	No indication of paragenesis with heavy metals could be determined.	Mining of metals generally poses a certain risk to contamination with	Medium	B2 = medium, classified according

		heavy metals, accordingly the EHP is medium.		to measurement instructions
Paragenesis with radioactive components	No indication of paragenesis with thorium and uranium.	In accordance with the measurement instructions, iron ore deposits are evaluated with a medium EHP, if no other information is available.	Medium	B2 = medium, classified according to measurement instructions
Deposit size	By considering statistical data, a total production of approx. 413 Mt iron ore between 1933 and 2018 was estimated (own calculation). Adding the current reserves of 2018 (180 Mt iron ore), the total deposit size is, with 33% Fe content approx. 197 Mt of iron ore.	The deposit can be classified as medium-sized. A medium EHP is assigned.	High	B1 = medium, can be estimated on the basis of available information
Ore grade	Open pit: 33.7 % Fe Underground: 54.4 % Fe (ArcelorMittal 2017)	In accordance with the measurement instructions, iron ore with grades between 30 % and 60 % are of average grade. Accordingly, the EHP caused by the 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	Most of the iron ore is mined at Kryvyi Rih's open pit sites. The iron ore extracted from the	Open-pit mines are usually limited to an area that is only slightly larger than the	Medium	A = high, can be derived directly

	Kryvyi Rih's underground mine by a modified sub-level caving method (ArcelorMittal 2017)	projection of the deposit body to the surface. Accordingly, the EHP resulting from the mining method is medium.		from available data
Use of auxiliary substances	<p>The beneficiation process is separated in crushing, grinding, classification and a series of magnetic separator units to increase the iron content (Barbosa et al. 2016).</p> <p>The iron ore extracted from the open pit is processed at the mine site through primary crushing. After this, the product is loaded on a rail-loading facility and transported to the crusher. The concentrator production process includes crushing, classification, magnetic separation and filtering.</p> <p>The iron ore extracted from the Kryvyi Rih's underground mine is crushed and transported by rail to the steel plant. The main consumption of the products takes place in ArcelorMittal Kryvyi Rih steel plant (ArcelorMittal 2017)</p>	Ore separation can include the application of reagents. Beside, only physical separation methods are applied. Accordingly, processing poses a medium EHP.	Medium	B2 = medium, classified according to measurement instructions
Mining waste	The total area of mining and processing amounts to 4,084.9 ha. The area of open pits is 648 ha. The size of waste rock dumps are 1,119 ha in total, the TSFs cover 863 ha and the industrial site 822 ha (ArcelorMittal n.d.)	Assuming a conservative depth of 1 m, the volume of the waste rock dumps is approx. 11.2 km <sup>3</sup> . According to the definition of (ICOLD 2018), the estimated TSF volume is considered to be large (> 3 Mio m <sup>3</sup> ). Large TSF's are evaluated with a high EHP.	High	B1 = medium, can be estimated on the basis of available information
Remediation measures	Asset Retirement Obligations (AROs) for Ukraine 44 Mio. US-\$. The AROs in Ukraine are legal obligations for site rehabilitation at the iron ore mining site in Kryvyi Rih, upon	There are site rehabilitation and restoration plans for mine closure in place. Accordingly, the EHP -due to	Low	A = high, can be derived directly from available data

	closure of the mine pursuant to its restoration plan (ArcelorMittal 2017)	satisfactory remediation measures- is low.		
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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.	The EHP for floods is high in the mining area which determines the evaluation result. The other indicators have a low EHP .	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 supplemented by desert areas. The highest hazard level of the sub-indicators determines the total result.	The water stress for the mining area is low and it is not situated in a desert area, which results in a low EHP.	Low	B2 = medium, classified according to 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 site is not situated in designated protected areas and AZE sites, which results in a low EHP.	Low	B2 = medium, classified according to measurement instructions

## State Governance

Indicators	
WGI 1 -Voice and Accountability	47.29 <sup>ooo</sup>
WGI 2 -Political Stability and Absence of Violence/ Terrorism	6.67 <sup>ooo</sup>
WGI 3 - Government Effectiveness	35.1 <sup>ooo</sup>
WGI 4 -Regulatory Quality	40.38 <sup>ooo</sup>
WGI 5 - Rule of Law	25 <sup>ooo</sup>
WGI 6 -Control of Corruption	22.12 <sup>ooo</sup>
EPI (Environmental Performance Index)	52.87
EITI membership	Yes since 2013. Current status is “meaningful progress”
International Agreements	
ILO 176	Ratification in 2011

Others	None
<b>Legal framework</b>	
Areas of Law: Environment	<p>According to Ukrainian law, it is necessary for investor to acquire several permits (Fedoruk / Sozanska-Matviychuk 2018). 1) approval of a drilling programme, 2) permit for performance of hazardous works and use of hazardous equipment issued by the State Labour Service, 3) permit for waste management activities issued by local State administrations (currently not issued due to lack of procedure), 4) air emission permit, 5) environmental impact assessment due to Law of Ukraine “On Environmental Impact Assessment” (from December 2017).</p> <p>The Law of Ukraine “On Waste Products” regulates the storage of tailings and declares, that tailings “shall be made in accordance with the environmental safety rules and with the use of methods providing maximum use of waste. For each place of tailing an appropriate pass with data on storage shall exist. Despite the above, an investor providing storage of tailings shall obtain an appropriate permit for such activity” (Fedoruk / Sozanska-Matviychuk 2018).</p> <p>The environmental assessment in Ukraine is a two-step process: 1) preparation of the environmental impact assessment documentation (called OVNS in Ukrainian), which includes an assessment of the potential impacts on the natural, manufactured and social environment as well as the design of prevention, mitigation and mitigation measures (responsibility of the developer); 2) Ecological Expertise (EE) - review of the prepared document by authorized governmental authorities and/or the public (World Bank 2016).</p>

<p>Areas of Law: Occupational Health and Safety (OHS)</p>	<p>The Ukrainian Labour Code contains a general obligation for the employer to ensure safe and harmless conditions for workers and they are also obliged to ensure safe environment conditions. Within the mining spheres, health and safety is covered by several laws (Fedoruk / Sozanska-Matviychuk 2018): 1) the Mining Law; the Law of Ukraine “On Ensuring the Sanitary and Epidemiological Safety of the Population”, 2) the Code for Civil Protection, 3) the Law of Ukraine “On Labour Protection”, 4) the Labour Code of Ukraine, 5) the Law “On Mining and Processing of Uranium Ore”, 6) the Safety Rules in Oil and Gas Mining Industry, 7) the Labour Protection Rules for Crushing, Sorting and Processing Mineral Resources and Lumping Ores and Concentrates. Albeit the many laws and protections rules, Ukraine achieves a very low rating in the ITUC Global Rights Index (5 of scale from 1 to 5). It is stated that it is impossible for workers to enforce their rights. This fact is due to the fundamentally failure of governmental institutions to punish them, who are responsible for systematic violations of human rights and humanitarian law (ITUC 2018).</p>
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## 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)?	Yes Yes, ArcelorMittal MAC Member (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?	Yes Yes (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 2018a)
Responsible Mining Index Company indicator „Working conditions“	0.537 0.537 (RMI 2018b)
Responsible Mining Index Company indicator „Environmental sustainability“	0.166 0.166 (RMI 2018b)
Responsible Steel (RS): Is the mine owner a member of the RS?	Yes Member Business (Responsible Steel 2019)
Responsible Steel (RS): Is the mine certified?	No No (Responsible Steel 2019)
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?	No information obtained No information available
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?	Yes Yes
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.

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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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