

ÖkoRess III

Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

Ingulets

Metinvest (Smart N.V.), Ukraine

ID: 27

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>


Ingulets

Iron ore


General information	
Indicator or criteria	Description and values
Name of mine	Ingulets
Description of mining area	<p>Ingulets is an iron ore mining & processing complex in south-central Ukraine, some 365 km south of the capital Kyiv (Kiev). Ingulets is located in a predominantly agricultural area with rather flat topography and isolated large iron ore mines of the Krivoy Rog Basin (“Krivbass”) (GoogleEarth 2019).</p> <p>Ingulets is one of several geophysical/magnetic anomalies within the early Precambrian metasedimentary and metavolcanic complexes of the Krivoy Rog-Kremenchug structural formation zone of the Ukrainian Shield (Pokalyuk 2017).</p> <p>Within the Proterozoic Krivoy Rog Series, the ore-bearing banded iron formation (BIF) consists of a ferruginous (iron-bearing) quartzite and slate sequence, which includes several BIF horizons intercalated with quartz-sericite, chlorite-sericite, slates and microquartzites (Porter GeoConsultancy 2019).</p> <p>The Ingulets stratiform quartzite deposits are located in the southern part of the Krivbass and extend over 100-1000 m at depth, 2.5 km length and 1.2 km width (“Ingulets Mining and Concentration Complex” n.d.)</p>
Surface extension	39.16km ² 39.16 km ² (Image date: 27.05.2018; Viewing height: 8.70 km) (Google Earth)
In operation since	1965 April 1965: First concentrate production (Metinvest 2019a)
Operator	PJSC InGOK
Owner	Metinvest (Smart N.V.)
Closest town	Shyroke, Inguletsky District (Google Earth 2019)
Province	Dnipropetrovsk (Google Earth 2019)
Country	Ukraine



Longitude	33.197°
Latitude	47.649222°
Altitude	90 m a.s.l. 90 m.a.s.l. (Google Earth 2018)
Main product and by-products	Main product: Iron (Fe); by-products: None (Metinvest 2019a)
On-site processing stages	<p>PJSC InGOK has 5 main production units:</p> <ul style="list-style-type: none"> • Open pit with a mining capacity of 70 Mt per year developing the Ingulets deposit of ferruginous quartzites • Haul truck fleet with a capacity of more than 60 Mt per year transporting ore to the crusher. • An in-pit railway system for ore and waste • Crushing and grinding section with a processing capacity of more than 36 Mt of crude ore per year • Two concentration plants with an annual production capacity of over 14.5 Mt of concentrate with 65 % to 67 % Fe content. • PJSC InGOK supplies iron ore concentrate as raw material for steel production and cast iron to metallurgical plants in Ukraine and for export to China, Hungary and the Czech Republic (Metinvest 2019a)
Annual production	Ingulets GOK: 12,278 kt of iron ore concentrate 2018 (Metinvest 2019b).
Proven Reserves	As at 31 December 2018, the combined proven & probable iron ore reserves of Metinvest's three assets in Ukraine (Ingulets GOK, Northern GOK, Central GOK) were 1,190 Mt according to JORC as at 1 January 2010 and adjusted for production of 676 Mt of reserves between 1 January 2010 and 31 December 2018 (Metinvest 2019b).
Probable Reserves	As at 31 December 2018, the combined proven & probable iron ore reserves of Metinvest's three assets in Ukraine (Ingulets GOK, Northern GOK, Central GOK) were 1,190 Mt according to JORC as at 1 January 2010 and adjusted for production of 676 Mt of reserves between 1 January 2010 and 31 December 2018 (Metinvest 2019b).

Geology 				
Indicator or criteria	Description and values	Explanation	Assessment result	Data quality
Preconditions for acid mine drainage (AMD)	Sulphur content of Krivbass iron ore deposits has been reported as minimal (under 0.05 % S) for three ore types and up to 0.15 % S for another ore type indicating low to very low preconditions for AMD (Porter GeoConsultancy 2019).	According to the Goldschmidt-Classification, iron is a siderophile element. Based on the measuring instructions for siderophile elements and considering the low to 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	No paragenesis of heavy metals could be determined.	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.	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	The Ingulets deposit holds 2,300 Mt of mineral resources (Metinvest 2019c) at an average grade of 35 % Fe (Porter GeoConsultancy 2019)	The current deposit size (assuming 2,300 Mt @ 35 % Fe or 805 Mt of contained iron) would be classified as a medium-size iron ore deposit, however, considering Ingulets ore production of estimated 15-20 Mt per	Medium	A = high, can be derived directly from available data

		annum since 1965, based on an annual capacity of around 10-12 Mt of iron ore concentrate, the original deposit size would exceed 1,000 Mt of contained Fe and be classified as a large deposit. According to the measurement instructions based on Petrow et al. (2008, in Dehoust et al. 2017b), this would indicate a medium EHP.		
Ore grade	Fe 35 % in mineral resources (Porter GeoConsultancy 2019).	Ingulets is rated as a medium grade deposit of predominantly magnetite quartzite ore, which indicates a medium EHP according to the 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 (Metinvest 2019a).	Conventional solid rock open pit mining is evaluated with a medium EHP. During open pit mining in solid rocks, 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 than in mining of alluvial or unconsolidated sediments.	Medium	A = high, can be derived directly from available data

Use of auxiliary substances	Mining is carried out by drill & blast method using TNT-free explosives. Haul trucks transport the ore within the quarry to haulage levels -60 m, -180 m and -240 m to crushing and dumping stations where coarse crushing takes place. The ore is then transported by underground conveyor tracks for reprocessing at the crushing plant (Metinvest 2019a). Beneficiation takes place in two processing units, a) using standard magnetic separation; and b) magnetic and flotation concentrate upgrading facility producing an ore concentrate of over 67 % Fe content with a capacity of 6.8 Mt/a (Metinvest 2019a). This new Ingulets beneficiation scheme includes blending of ore types, flotation using flocculants (chemical reagents, several de-sliming, filtering and magnetic separation stages, and clarification of recycled water (ABB 2019).	Ore processing and beneficiation at Ingulets GOK involves crushing, sorting and magnetic separation methods, however, it also uses flotation processes including toxic agents and thus a high EPH is indicated according to the measurement instructions.	High	B1 = medium, can be estimated on the basis of available information
Mining waste	Overburden and mine waste is placed in external dumps constructed on flat topography. Ingulets has implemented an environmental safety system certified in accordance with ISO 14001 (Metinvest 2019d).	Waste management plans are in place for dumps, therefore, a low EPH is indicated.	Low	B1 = medium, can be estimated on the basis of available information
Remediation measures	Biological reclamation works are carried out on Ingulets waste dumps. For several years, experiments have been carried out on landscaping waste dumps). To facilitate intensive overgrowth of dumps by green species, i.e. the surface is stabilized by the root	Remediation policies and plans in accordance with ISO 14001 are in place. Effluent discharge from plant, waste dumps and TSF are being checked and monitored. Existing monitoring and	Low	A = high, can be derived directly from available data

	<p>system of perennial grasses, which prevents the spread of dust and subsequently forms an artificial fertile layer (Metinvest 2019d). The Ingulets River is contaminated by the effluent disposal and wastes of the metallurgic factories. A new water quality improvement technique was introduced in 2010 based on FAO and [Ukrainian Law] DSTU 2730-94 criteria. It was established that water quality in the Ingulets River is still poor, though it has improved each year since 2010 till today (Lykhovyd / Kozlenko 2018)</p>	<p>rehabilitation plans would indicate a low EHP.</p>		
--	--	---	--	--

Framework conditions natural environment



Indicator or criteria	Description and values	Explanation	Evaluation result	Data quality
<p>Accident hazard due to floods, earthquake, storms, landslides</p>	<p>The rating system for the 4 sub-indicators uses geo-referenced 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.</p>	<p>The mining area is located alongside the Ingulets River with a medium EHP for floods (rated 2) which determines the evaluation result. The other sub-indicators have a low EHP.</p>	<p>Medium</p>	<p>A = high, can be derived directly from available data</p>
<p>Water Stress Index (WSI) und desert areas</p>	<p>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</p>	<p>The water stress for the mining area is low and the complex is not situated in a desert area, which results in a low EHP.</p>	<p>Low</p>	<p>A = high, can be derived directly from available data</p>

	hazard level of the sub-indicators determines the total result.			
Protected areas and AZE sites	Geo-referenced 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 mining area is not situated in 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	44.83 ^{ooo}
WGI 2 -Political Stability and Absence of Violence/ Terrorism	6.19 ^{ooo}
WGI 3 - Government Effectiveness	38.46 ^{ooo}
WGI 4 -Regulatory Quality	44.23 ^{ooo}
WGI 5 - Rule of Law	24.04 ^{ooo}
WGI 6 -Control of Corruption	18.27 ^{ooo}

EPI (Environmental Performance Index)	52.87
EITI membership	Yes, since 2013. Current status is “meaningful progress” (EITI 2019)
International Agreements	
ILO 176	Ratification 15 June 2011, Status: “in Force”
Others	Paris Agreement on Climate Change, adopted in Paris, France, under the United Nations Framework Convention on Climate Change, signed by Ukraine 22 Apr 2016, ratified 19 Sep 2016 (UNTC 2019).
Legal framework	

<p>Areas of Law: Environment</p>	<p>According to Ukrainian law, it is necessary for investor to acquire several permits (Fedoruk / Sozanska-Matviychuk 2018):</p> <ol style="list-style-type: none"> 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>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, storage appropriate passport 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>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):</p> <ol style="list-style-type: none"> 1) the Mining Law; 2) the Law of Ukraine “On Ensuring the Sanitary and Epidemiological Safety of the Population”; 3) the Code for Civil Protection; 4) the Law of Ukraine “On Labour Protection”; 5) the Labour Code of Ukraine; 6) the Law “On Mining and Processing of Uranium Ore”; 7) the Safety Rules in Oil and Gas Mining Industry; 8) the Labour Protection Rules for Crushing, Sorting and Processing Mineral Resources and Lumping Ores and Concentrates. <p>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</p>

	governmental institutions to punish those who are responsible for systematic violations of human rights and humanitarian law (ITUC 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 Yes. The management company (Metinvest Holding B.V.) received its first certificates of approval in 2009 (Metinvest 2019a)

CSR-directive 2014/95/EU: Does the mine owning company have its headquarters in an EU country?	Yes Yes, Netherlands (Metinvest 2019a)
OECD Guidelines: Does the company have its headquarters in a signatory state?	Yes Yes (OECD 2019)
ISO 26000: Does the mine implement ISO 26000?*	No information obtained No information available
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

ABB (n.d.): Freelance DCS supports further modernization of the mining ore plant in Ukraine. <https://new.abb.com/control-systems/industry-specific-solutions/mining/freelance-ingulets-gok-mining-ore-plant-sautcom>. (26.02.2020).

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 (ökoRess 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).

Fedoruk, D.; Sozanska-Matviychuk, Z. (2018): Ukraine. In: ICLG - The International Comparative Legal Guide to: Mining Law 2018. GLOBAL LEGAL Group LTD.

ICMM (2019): Member companies. In: International Council on Mining and Metals (ICMM). <https://www.icmm.com/en-gb/members/member-companies>. (16.04.2019).

ILO (2017): Ratifications of C176 - Safety and Health in Mines Convention, 1995 (No. 176). In: International Labour Organization (ILO). http://www.ilo.org/dyn/normlex/en/f?p=1000:11300:0::NO:11300:P11300_INSTRUMENT_ID:312321. (12.04.2018).

Ingulets Mining and Concentration Complex (n.d.): <http://krt.dp.ua/en/working/37-complexes/64-ingulets-mining-and-concentration-complex>. (26.02.2020).

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).

ITUC (2018): ITUC Global Rights Index. International Trade Union Confederation (ITUC). <https://www.ituc-csi.org/IMG/pdf/ituc-global-rights-index-2018-en-final-2.pdf> (24.04.2019).

Lykhovyd, P. V.; Kozlenko, Ye. V. (2018): Assessment and forecast of water quality in the River Ingulets irrigation system. In: Ukrainian Journal of Ecology. Vol. 8, No.1, S. 350–355.

MAC (2019): Our Members. In: The Mining Association of Canada (MAC). <http://mining.ca/members-partners/our-members>. (16.04.2019).

Metinvest (2019a): Inguletsky GOK. <https://ingok.metinvestholding.com/ru>. (05.03.2020).

Metinvest (2019b): Annual Report and Accounts 2018. https://metinvestholding.com/ar2018/assets/downloads/Metinvest_AR_2018.pdf (05.12.2019).

Metinvest (2019c): Company - Structure. <https://ingok.metinvestholding.com/ru/about/structure>. (05.03.2020).

Metinvest (2019d): Responsibility - Caring for the environment. <https://ingok.metinvestholding.com/ru/responsibility/safety/environment>. (06.12.2019).

OECD (2019): Member Countries. In: Organisation for Economic Co-operation and Development (OECD). <https://www.oecd.org/about/members-and-partners/>. (05.11.2019).

- 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.
- Pokalyuk, V. V. (2017): Lithogenesis of the early Precambrian of the Krivoy Rog iron ore basin. Lambert Academic Publishing, Balti, Moldova.
- Porter GeoConsultancy (n.d.): Krivoy Rog, Krivoi Rog - Ingulets, Saksagan, Pervomaisk, Annovsk, Zheltorechensk and Popelnostovsk. <http://www.portergeo.com.au/database/mineinfo.asp?mineid=mn1023>. (26.02.2020).
- 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.
- Responsible Steel (2019): Members and Associates. <https://www.responsiblesteel.org/membership/members-and-associates/>. (07.01.2019).
- RMI (2018): Companies. In: Responsible Mining Index (RMI). /en/companies/29. (16.04.2019).
- UNTC (2019): Paris Agreement. In: United Nations Treaty Collection (UNTC). https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-7-d&chapter=27&clang=_en. (05.11.2019).
- 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

Publisher:

German Environment Agency
Section III 2.2
PO Box 14 06
06813 Dessau-Rosslau, Germany
Tel: +49 340-2103-0
info@umweltbundesamt.de
www.umweltbundesamt.de

Contact:

Jan Kosmol – jan.kosmol@uba.de

Project period: 03/2018 –02/2021

The research project has been commissioned by the German Environment Agency as part of the Environmental Research Plan of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and funded by the Federal Government (FKZ: 3717 35 306 0).

Contractor:

Projekt-Consult GmbH
Eulenkruogstrasse 82
22359 Hamburg, Germany
T +49 (40) 60306-740
F +49 (40) 60306-199
www.projekt-consult.de

Contact:

Dr. Aissa Rechlin – aissa.rechlin@projekt-consult.de
Christopher Demel – christopher.demel@projekt-consult.de

Project Partners:

- ifeu – Institut für Energie-und Umweltforschung Heidelberg gGmbH (Institute for Energy and Environmental Research)
- Öko-Institut e.V. (Institute for Applied Ecology)