# ÖkoRess III

# Pilot Screening of Environmental Hazard Potentials of Mine Sites

Factsheet:

## Minntac

## United States Steel, USA

ID: 26

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

# Minntac

## Iron ore

## General information

| Indicator or criteria | Description and values |
|---|---|
| Name of mine | Minntac |
| Description of mining area | The operations are located at Mt. Iron in the Mesabi iron ore range. The iron bearing rock is classified at taconite and is processed into iron ore pellets to be used in the company's own steelmaking facilities (United States Steel 2019a).<br>The sedimentary ore body has a primary material cover of sand and gravel, consists of hard rocks, with an average bench height of 12 m and a maximum put slope of 68 degrees (USGS 2005). |
| Surface extension | 140.6km$^2$ 140.60 km$^2$ (Image date: 14.08.2015; Viewing height: 15.24 km) (Google Earth) |
| In operation since | 1967 1967(USGS 2005) |
| Operator | United States Steel |
| Owner | United States Steel |
| Closest town | City of Mountain Iron, the mine is less than 5km away from the city. |
| Province | Minnesota |
| Country | USA |
| Longitude | -92.6377° |
| Latitude | 47.56667° |
| Altitude | 530 m a.s.l. 530 m a.s.l. (Google Earth) |
| Main product and by-products | Main product: Iron Ore (processed to iron ore pellets); by-product: none (United States Steel 2019b) |

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|---|---|
| On-site processing stages | The plant on site includes a crusher, a crusher thickener, a concentrator and agglomerator (Minnesota Pollution Control Agency 2018) |
| Annual production | 14.42 Mt iron ore pellets (United States Steel 2019b) |
| Proven Reserves | 421 Mt iron ore pellets are noted in total as proven and probable reserves (United States Steel 2019b) |
| Probable Reserves | 421 Mt iron ore pellets are noted in total as proven and probable reserves (United States Steel 2019b) |

## Geology

| Indicator or criteria | Description and values | Explanation | Assessment result | Data quality |
|---|---|---|---|---|
| Preconditions for acid mine drainage (AMD) | Presence of sulphates and other pollutants in the mines' tailings dam are known and documented; the mine is required to observe a 357 mg/L limit of sulphates (Minnesota Pollution Control Agency 2016). | Given the presence of sulphates and also documented cases of tailings seepage, a High EHP rating is given. | High | A = high, can be derived directly from available data |
| Paragenesis with heavy metals | No current information could be obtained. An environmental impact statement from 2004 states that "Metals in Minntac tailings discharge water, with the exception of manganese, are below drinking water quality standard limits" (MWH 2004). | As there is no direct information on the paragenesis with heavy metals available or other current information, the measurement instructions are referred to. These indicate that oxidic iron ores can be associated with heavy metals such as lead, zinc, copper, chrome, and arsenic. Accordingly, heavy metals and arsenic may have a limited relevance in the extraction of oxidic iron ores, leading to a medium EHP (Dehoust et al. 2017). | Medium | B2 = medium, classified according to measurement instructions |

| | | | | |
|---|---|---|---|---|
| Paragenesis with radioactive components | No specific information on Minntac could be obtained. | In line with the measurement instructions, with possible indication of Thorium and Uranium, a Medium EHP is assigned. | Medium | B2 = medium, classified according to measurement instructions |
| Deposit size | The mine started production in 1967, at current production volumes a total of ca. 720 Mt of pellets have been produced. Adding the reserves, a total volume of 1,140 Mt of pellets could be produced from the deposit. Assuming iron contents of ca. 65 % (United States Steel 2018a) in the pellets the deposit adds up to 740 Mt of iron (United States Steel 2019; USGS 2005). | According Petrow et al., Minntac is classified as a medium-sized project and is hence given a medium EHP (Dehoust et al. 2017). | Medium | A = high, can be derived directly from available data |
| Ore grade | Taconite iron deposits in the US tend to have a low (20-30 %) Fe grade (US EPA 2003). Minntac has a reported ore grade of 20 % (Hubbel 2001). | Priester et al. (2019) categorize iron ore with grades below 30 % as low-grade deposits. With 20 % Fe content the ore grade at Minntac is very low. Therefore, according to the measuring instructions a high EHP is awarded. | High | A = high, can be derived directly from available data |

## Technology

| Indicator or criteria | Description and values | Explanation | Evaluation result | Data quality |
|---|---|---|---|---|

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|---|---|---|---|---|
| Mine type | Conventional drill, blast, truck and shovel open-pit operations. The ore body in Minnesota is known to be shallow and close to the surface (US EPA 2003). | 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 | B1 = medium, can be estimated on the basis of available information |
| Use of auxiliary substances | Auxiliary substances used in the processing include flocculants and various flotation reagents (Minnesota Pollution Control Agency 2018). | The processing plant does use auxiliary substances for flotation which tend to be toxic, although they are not specified. The mine is awarded a High EHP, following the measurement instructions. | High | B1 = medium, can be estimated on the basis of available information |
| Mining waste | An average of 21.3 Mt f dry fine tailings and 14.2 Mt of dry coarse tailings are annually deposited in a tailings basin, which has also exhibited sulphate and other pollutant seepage. The tailings are associated with the processing that takes place at the mine site. The Minntac Tailings Basin Area facility covers an area of ca. 35 $km^2$ (Minnesota Pollution Control Agency 2018).<br>The tailings dam associated with the processing plan has been an ongoing cause of concern for sulphate seepage into water reservoirs (Minnesota Pollution Control Agency 2016). | The mine site incorporates processing that produces waste slurry (particle size of less than 0.2 mm) which is stored in a tailings storage facility (TSF), with a dam height of 35 m (Minnesota Pollution Control Agency 2018). The TSF is a large dam as defined by ICOLD. Accordingly, a high EHP is awarded for the mining waste management (Dehoust et al. 2017). | High | A = high, can be derived directly from available data |
| Remediation measures | It was not possible to identify a mine closure or rehabilitation plan, nor indications for parallel remediation measures are found. The records show that some of the coarse tailings are used for sanding roads as well as being sold as aggregate product (Minnesota Pollution Control Agency 2018). | No details for parallel remediation, or financial measures for mine closure and rehabilitation could be identified for Minntac. A High EHP is therefore awarded in line with measurement instructions. | High | B2 = medium, classified according to measuring instructions |

## 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 all sub-indicators are low (earthquakes, landslide, tropical storm, arctic region) except for floods which is high leading to an overall high EHP. | High | A = high, can be derived directly from available data |
| 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 mining area is low and 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 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 | 82.27 °°° |
| WGI 2 -Political Stability and Absence of Violence/ Terrorism | 59.05 °°° |
| WGI 3 - Government Effectiveness | 92.79 °°° |
| WGI 4 -Regulatory Quality | 92.79 °°° |
| WGI 5 - Rule of Law | 91.83 °°° |
| WGI 6 -Control of Corruption | 88.94 °°° |
| EPI (Environmental Performance Index) | 71.19 |
| EITI membership | No (EITI 2019), the US joined the EITI in 2014 and withdrew from the EITI in 2017 |
| **International Agreements** | |
| ILO 176 | Yes, ratified in 2001 |

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|---|---|
| Others | OECD member |
| **Legal framework** | |
| Areas of Law: Environment | The National Environmental Policy Act (NEPA) is the principal environmental law implicated by mining on federal lands. It requires federal agencies to take a "hard look" at the environmental consequences of its projects before action is taken. An agency must prepare an Environmental Impact Statement (EIS) for all major federal actions significantly affecting the quality of the human environment. The analysis generally requires consideration of other substantive environmental statutes and regulations, including the Clean Air Act, the Clean Water Act and the Endangered Species Act. State laws may also require environmental analysis. Third parties may sue the federal agency completing the review to ensure that the agency considered all relevant factors and had a rational basis for the decisions made based on the facts found. Prosecuting the litigation would extend the project approval time, and if the agency loses, additional time would be required for the agency to redo its flawed NEPA analysis (Kahalley 2018).<br>The Clean Air Act is administered by the Environmental Protection Agency (EPA) and states with delegated authority. The Clean Water Act is administered by the EPA, the US Army Corps of Engineers, and states with delegated authority. The US Fish and Wildlife Service and National Marine Fisheries Service administer the Endangered Species Act. States also have a wide range of environmental laws that govern permitting and reclamation on mining projects. A variety of federal and state laws govern the storage of tailings and other waste products on mining operations and for the closure of mines. In general, a mine plan must provide a detailed description of how the mine operations will comply with such requirements (Kahalley 2018).<br>The Federal Land Policy and Management Act (FLPMA) requires the US Bureau of Land |

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| | Management (BLM) and the US Forest Service (USFS) to prevent unnecessary or undue degradation of public lands. BLM and USFS reclamation standards include saving topsoil for reshaping disturbed areas, erosion and water control measures, toxic materials measures, reshaping and re-vegetation where reasonably practicable, and rehabilitation of fish and wildlife habitat. State laws may also include closure and reclamation requirements. Federal and state laws generally require financial guarantees prior to commencing operations to cover closure and reclamation costs (Kahalley 2018). |
| Areas of Law: Occupational Health and Safety (OHS) | The Federal Mine Safety and Health Act requires the Mine Safety and Health Administration (MSHA) to inspect all mines each year to ensure safe and healthy work environments. MSHA is prohibited from giving advance notice of an inspection, and may enter mine property without a warrant. MSHA regulations set out detailed safety and health standards for preventing hazardous and unhealthy conditions, including measures addressing fire prevention, air quality, explosives and others. MSHA regulations also establish requirements for: testing, evaluating, and approving mining products; miner and rescue team training programmes; and notification of accidents, injuries, and illnesses at the mine. Owners, employers, managers and employees all have obligations under the laws described in question (Kahalley 2018). |

## Corporate Social Responsibility (CSR)

| **Voluntary Standards** | |
|---|---|
| Aluminium Stewardship Initiative (ASI):<br>Is the mine owning company a member? | Not applicable Not applicable |
| Aluminium Stewardship Initiative (ASI):<br>Is the mine certified? | Not applicable Not applicable |
| International Council of Mining & Metals (ICMM):<br>Is the mine owning company a member? | No No (ICMM 2019) |
| Towards Sustainable Mining (TSM)<br>Is the mine owning company a member of the Mining Association of Canada (MAC)? | No No (MAC 2019) |
| Towards Sustainable Mining (TSM) outside Canada:<br>Are TSM standards implemented*? | Not applicable Not applicable |
| Initiative for Responsible Mining Assurance (IRMA):<br>Is the mine owning company a member? | No No (IRMA 2018) |
| Initiative for Responsible Mining Assurance (IRMA):<br>Is the mine certified? | No No (IRMA 2018) |
| Responsible Copper (RC):<br>Is the mine owning company a member of RC? | Not applicable Not applicable |
| Responsible Copper (RC):<br>Is the mine certified? | Not applicable Not applicable |
| Responsible Mining Index (RMI):<br>Has the mine been rated? | No No (RMI 2018a) |
| Responsible Mining Index<br>Company indicator „Working conditions“ | No No (RMI 2018b) |

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|---|---|
| Responsible Mining Index<br>Company indicator „Environmental sustainability“ | No No (RMI 2018b) |
| Responsible Steel (RS):<br>Is the mine owner a member of the RS? | No No (Responsible Steel 2019) |
| Responsible Steel (RS):<br>Is the mine certified? | Not applicable Not applicable. |
| Australian Steel Stewardship Forum (ASSF):<br>Is the owner a member of the ASSF? | No No (Australian Steel Stewardship Forum 2019) |
| Australian Steel Stewardship Forum:<br>Is the mine certified? | Not applicable Not applicable. |
| **ISO and CSR reporting** | |
| ISO 14001 (ISO 14004):<br>Is the mine ISO 14001 certified? | Yes Yes (United States Steel 2018b) |
| CSR-directive 2014/95/EU:<br>Does the mine owning company have its headquarters in an EU country? | No No |
| OECD Guidelines:<br>Does the company have its headquarters in a signatory state? | Yes Yes – The United States. |
| ISO 26000:<br>Does the mine implement ISO 26000?* | No information obtained Not indicated in company documents. |
| **Banking Standards** | |
| WB Standards / IFC Performance Standards:<br>Is the mine financed to a major extend by the world bank? | No No (IFC n.d.) |
| Equator Principles (EP):<br>Is the mine financed to a major extend by a bank adherent to the EP? | No information obtained Not indicated in company documents. |

*by companies own account.

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# A Glossary

**Table 1 Legend**

## Environmental hazard potential

*low*

*medium*

*high*

## Data quality

*low*

- 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.

*medium*

- Assessable on the basis of available information.
- Generalized classification according to measurement instructions.

*high*

- 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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