ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A2 & ISO 14025 / ISO 21930

Magnetite Fines and Concentrate from Malmberget

LKAB Minerals AB

- MagnaChem WT
- MagnaDense 0,5 & 2
- Magnetite 0,2-2

EPD HUB, HUB-2423
Published on 25.01.2025, last updated on 25.01.2025, valid until 24.01.2030

Created with One Click LCA

GENERAL INFORMATION

MANUFACTURER

Manufacturer	LKAB Minerals AB
Address	Varvsgatan 45, 972 33, Luleå, SE
Contact details	minerals@lkab.com
Website	https://www.lkabminerals.com/

EPD STANDARDS, SCOPE AND VERIFICATION

Program operator	EPD Hub, hub@epdhub.com
Reference standard	EN 15804+A2:2019 and ISO 14025
PCR	EPD Hub Core PCR Version 1.1, 5 Dec 2023
Sector	Construction product
Category of EPD	Third party verified EPD
Scope of the EPD	Cradle to gate (A1-A3)
EPD author	Marcus Eriksson
EPD verification	Independent verification of this EPD and data, according to ISO 14025: ☐ Internal verification ☑ External verification
EPD verifier	Haiha Nguyen, as an authorized verifier acting for EPD Hub Limited

The manufacturer has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

PRODUCT

Product name	Magnetite Fines and Concentrate from Malmberget
Additional labels	MagnaChem WT, MagnaDense 0,5 & 2, Magnetite 0,2-2
Place of production	Malmberget, Sweden
Period for data	2023 (calendar year)
Averaging in EPD	Multiple products
Variation in GWP-fossil for A1-A3	0,9 %

ENVIRONMENTAL DATA SUMMARY

Declared unit	1 metric tonne
Declared unit mass	1000 kg
GWP-fossil, A1-A3 ($kgCO_2e$)	11,8
GWP-total, A1-A3 ($kgCO_2e$)	12,5
Total energy use, A1-A3 (kWh)	250
Net freshwater use, A1-A3 (m^3)	0.28

PRODUCT AND MANUFACTURER

ABOUT THE MANUFACTURER

LKAB Minerals is part of the LKAB Group - an international mining and minerals group that offers sustainable iron ore, minerals and special products. LKAB Minerals supplies raw materials into diverse markets, from agriculture to water purification and construction. LKAB Minerals has deposits, processing facilities, and offices in 12 countries.

LKAB Minerals AB is certified according to standards for Quality, Environment and Working Environment (ISO9001, ISO14001 and ISO45001). Products are produced according to the Construction Products Regulation (CPR) within the EU regulation 305/2011. Sampling and testing are performed according to harmonised standards in EN12620.

PRODUCT DESCRIPTION

Magnetite is a naturally occurring iron oxide (Fe_3O_4), which is milled and sold as aggregates in different grades with top sizes ranging from <2 mm (iron ore fines) to <0,5 mm (concentrate). The magnetite fines and concentrate contain >97,5 % Fe_3O_4 and <2,5 % gangue rock.

Magnetite is ferri-magnetic and can be separated from non-magnetic material by using magnetic separation. Magnetite can be stored outdoors without deterioration. Products are stable under normal ambient conditions and has an indefinite shelf life.

The magnetite fines and concentrate from Malmberget are used in several sectors, e.g. for water treatment (under the product name MagnaChem WT), as heavy aggregates and for heat storage. In all use cases relevant for the Malmberget fines and concentrate grades, the magnetite is used as intermediary material in further refined end-products.

Magnetite fines used as heavy aggregates are certified according to EN 12620:2002/A1:2008.

Further information can be found at https://www.lkabminerals.com/.

PRODUCT RAW MATERIAL MAIN COMPOSITION

Raw material category	Amount, mass %	Material origin
Minerals	100	Malmberget, Sweden

BIOGENIC CARBON CONTENT

There is no biogenic carbon stored in the magnetite or packaging.

FUNCTIONAL UNIT AND SERVICE LIFE

Declared unit	1 metric tonne
Mass per declared unit	1000 kg
Reference service life	N/A – depends on end product

SUBSTANCES, REACH - VERY HIGH CONCERN

As per the requirements of the EU-REACH (1907/2006) and its subsequent amendments and The REACH etc. (Amendment etc.) (EU Exit) Regulations 2020, we can advise you that the products are REACH compliant and exempt from registration under Article 2 (7) (b) as detailed in Annex V, entry 7 (i) by virtue of being a mineral which occurs in nature and has not been chemically modified. The product does not contain any REACH SVHC substances in amounts greater than 0,1 % (1000 ppm).

PRODUCT LIFE-CYCLE

SYSTEM BOUNDARY

This EPD covers the life-cycle modules listed in the following table.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D		
×	×	×	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND		
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/ demolition	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR

MANUFACTURING AND PACKAGING (A1-A3)

The environmental impacts considered for the product stage cover the manufacturing of raw materials used in the production as well as packaging materials and other ancillary materials. Also, fuels used by machines, and handling of waste formed in the production processes at the manufacturing facilities are included in this stage. The study also considers the material losses occurring during the manufacturing processes as well as losses during electricity transmission.

Magnetite (iron oxide, Fe_3O_4) is mined and crushed in the underground iron ore mine in Malmberget and hoisted to the surface, where it is sorted and processed to remove gangue rock and impurities through several crushing and separation steps. In the mine, the main resources used are concrete, explosives (both of which are produced in our own factories), steel and energy (fuel and electricity), which are all classified as ancillary materials.

In the processing plant, a fraction of the magnetite flow is diverted to create the magnetite fines and concentrate. The majority of the magnetite flow is further processed into iron ore pellets (the primary product). The diverted magnetite flow is milled and screened into several grades of magnetite that is sold to the market. The additional input needed for the diverted flow is electricity. After having reached the desired grades, the magnetite fines and concentrate are transported to Luleå harbour by fully electric trains, after which it is shipped to customers as bulk material without packaging.

The difference between Magnetite fines and concentrate is that concentrate is a smaller fraction requiring one extra grinding step.

Over/undersized magnetite particles are recirculated continuously until the right size it met, reducing waste and tailings. Gangue rock is sorted out and removed throughout the process and is transported to tailings dams within the mining area.

In this EPD, we define the boundary for A3 (gate) as magnetite fines and concentrate ready to be shipped from Luleå harbour. Thus, the transport by electric train from Malmberget to Luleå harbour is included in A3. The GWP-fossil from the train transport to Luleå harbour is 0,1 kg CO2e per metric tonne.

TRANSPORT AND INSTALLATION (A4-A5)

Transport and installation are outside of the system boundaries of this EPD.

PRODUCT USE AND MAINTENANCE (B1-B7)

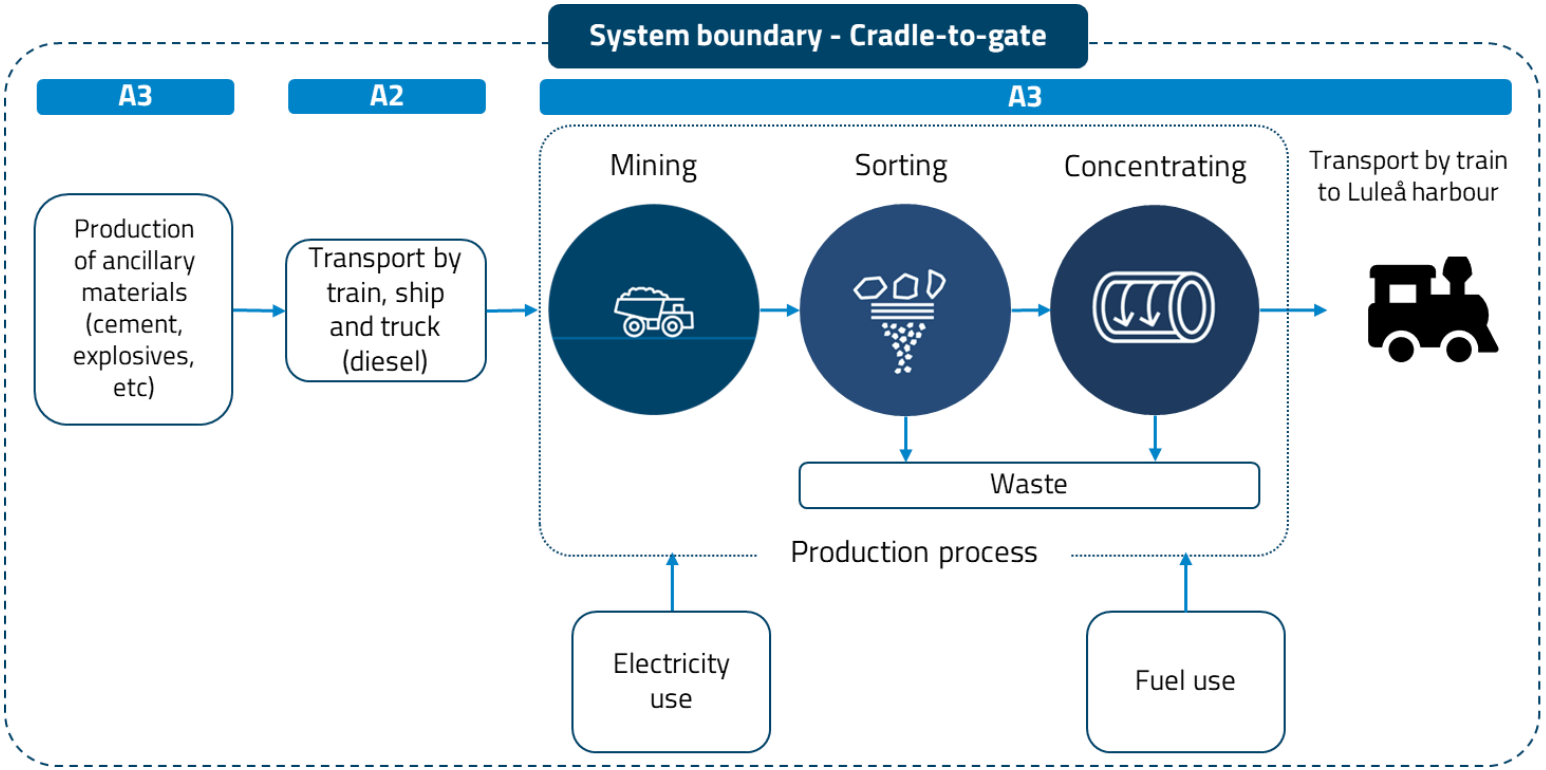
Product use and maintenance are outside of the system boundaries of this EPD.

PRODUCT END OF LIFE (C1-C4, D)

The magnetite fines and concentrate fulfil the criteria specified in the relevant PCR (EN 15804:2012+A2:2019) for excluding the end-of-life stage, and this stage is therefore not included in this EPD.

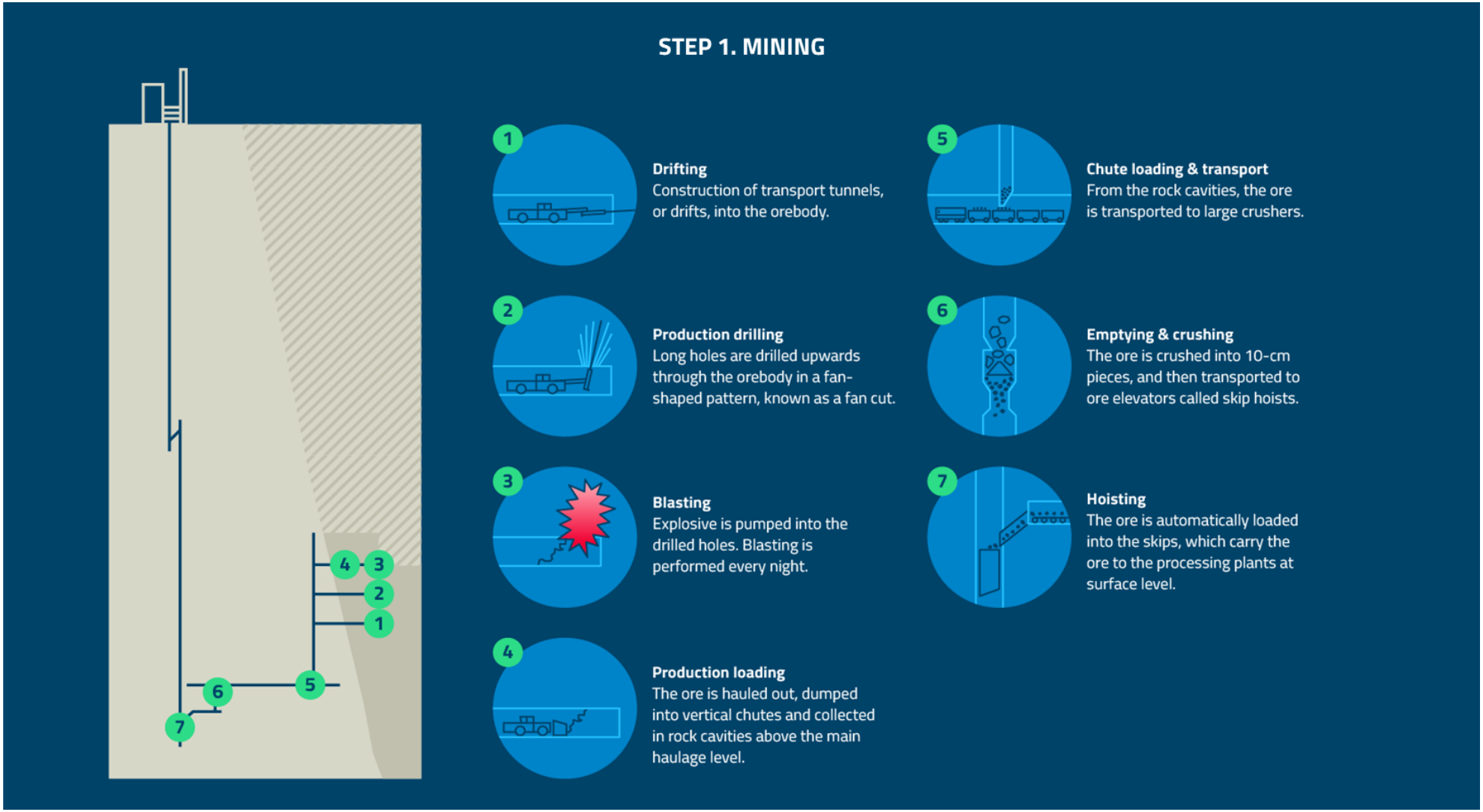
1. The product is physically integrated with the end product during installation so they cannot be physically separated at end of life
2. The product is no longer identifiable at end of life as a result of a physical or chemical transformation process
3. The product does not contain any biogenic carbon

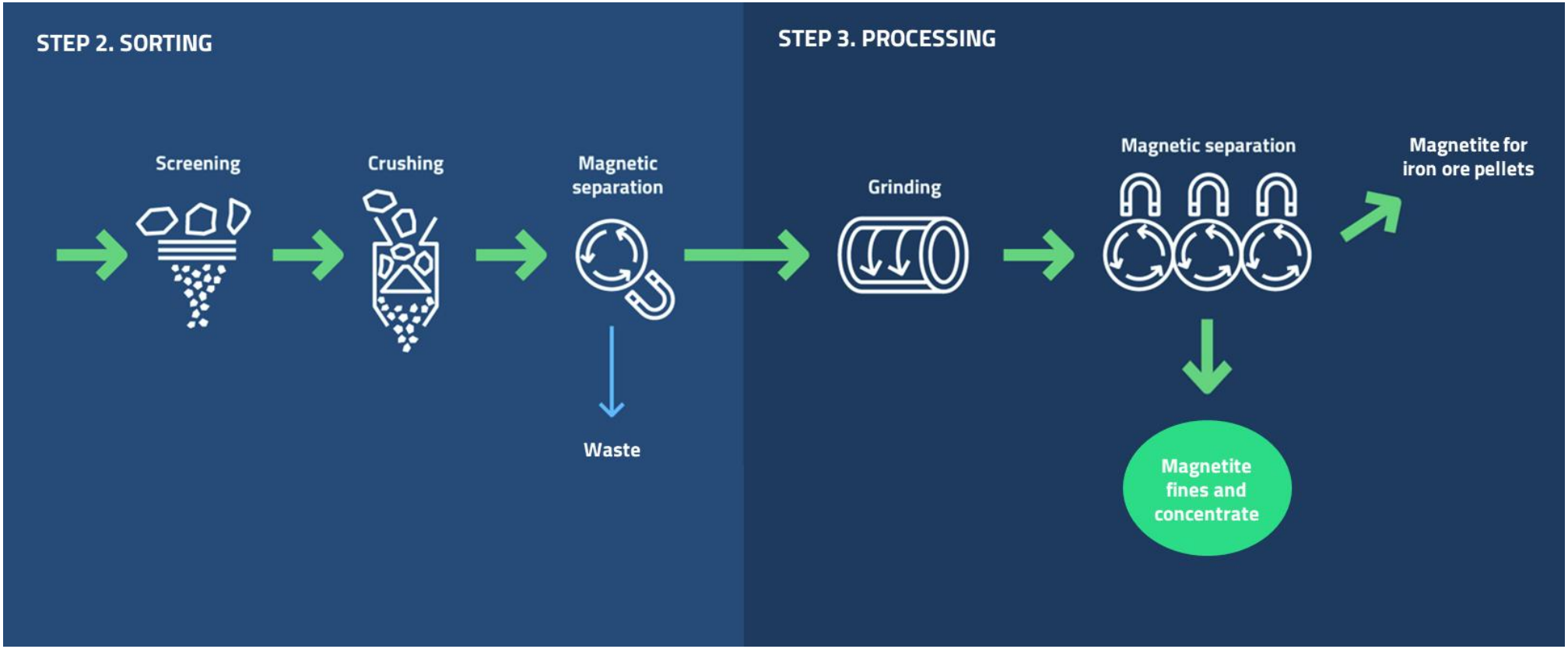
SYSTEM BOUNDARY



Life cycle stages A4-A5, B, C and D are outside of system boundaries

MANUFACTURING PROCESS




STEP 2. SORTING
Screening
Crushing
Magnetic separation
Waste
STEP 3. PROCESSING
Grinding
Magnetic separation
Magnetite for iron ore pellets
Magnetite fines and concentrate

LIFE-CYCLE ASSESSMENT

CUT-OFF CRITERIA

The study does not exclude any modules or processes which are stated mandatory in the reference standard and the applied PCR. The study does not exclude any hazardous materials or substances. The study includes all major raw material and energy consumption. All inputs and outputs of the unit processes, for which data is available for, are included in the calculation. There is no neglected unit process more than 1% of total mass or energy flows. The module specific total neglected input and output flows also do not exceed 5% of energy usage or mass.

ALLOCATION, ESTIMATES AND ASSUMPTIONS

Allocation is required if some material, energy, and waste data cannot be measured separately for the product under investigation. All allocations are done as per the reference standards and the applied PCR. In this study, allocation has been done in the following ways:

Data type	Allocation
Raw materials	No allocation
Packaging material	Not applicable
Ancillary materials	Allocated by mass
Manufacturing energy and waste	Allocated by mass

AVERAGES AND VARIABILITY

Type of average	Multiple products
Averaging method	Averaged by shares of total mass
Variation in GWP-fossil for A1-A3	0,9 %

After the magnetite is diverted from the main product stream, it is processed in either the fines or concentrate process, where it is milled and filtered to the right size and properties. The magnetite concentrate process uses one additional grinding step which results in slightly more electricity per ton compared to magnetite fines. This EPD is the weighted average of those two processes.

LCA SOFTWARE AND BIBLIOGRAPHY

This EPD has been created using One Click LCA EPD Generator. The LCA and EPD have been prepared according to the reference standards and ISO 14040/14044. The EPD Generator uses Ecoinvent v3.10 and One Click LCA databases as sources of environmental data.

ENVIRONMENTAL IMPACT DATA

CORE ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP – total[1)]	kg CO_2e	0,00E+00	3,97E-01	1,21E+01	1,25E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
GWP – fossil	kg CO_2e	0,00E+00	3,95E-01	1,14E+01	1,18E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
GWP – biogenic	kg CO_2e	0,00E+00	4,54E-04	6,47E-01	6,47E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
GWP – LULUC	kg CO_2e	0,00E+00	1,24E-03	2,37E-03	3,61E-03	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Ozone depletion pot.	kg CFC-$_{11}$e	0,00E+00	9,13E-09	2,10E-07	2,19E-07	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Acidification potential	mol H^+e	0,00E+00	2,73E-03	7,90E-02	8,18E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
EP-freshwater[2)]	kg Pe	0,00E+00	4,30E-05	1,61E-01	1,61E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
EP-marine	kg Ne	0,00E+00	1,12E-03	3,84E-02	3,96E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
EP-terrestrial	mol Ne	0,00E+00	1,21E-02	3,60E-01	3,72E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
POCP ("smog")[3)]	kg NMVOCe	0,00E+00	3,37E-03	1,03E-01	1,06E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
ADP-minerals & metals[4)]	kg Sbe	3,67E-05	9,93E-07	3,30E-05	7,06E-05	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
ADP-fossil resources	MJ	0,00E+00	3,33E+01	8,78E+02	9,11E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Water use[5)]	m^3e depr.	0,00E+00	3,75E-01	8,97E+00	9,35E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

1) GWP = Global Warming Potential; 2) EP = Eutrophication potential. Required characterisation method and data are in kg P-eq. Multiply by 3,07 to get PO4e; 3) POCP = Photochemical ozone formation; 4) ADP = Abiotic depletion potential; 5) EN 15804+A2 disclaimer for Abiotic depletion and Water use and optional indicators except Particulate matter and Ionizing radiation, human health. The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

ADDITIONAL (OPTIONAL) ENVIRONMENTAL IMPACT INDICATORS – EN 15804+A2, PEF

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Particulate matter	Incidence	0,00E+00	2,98E-08	2,02E-06	2,05E-06	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Ionizing radiation[6)]	kBq U235e	0,00E+00	2,19E+00	4,18E+01	4,39E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Ecotoxicity (freshwater)	CTUe	0,00E+00	7,58E-01	2,47E+03	2,47E+03	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Human toxicity, cancer	CTUh	0,00E+00	1,08E-10	3,34E-09	3,45E-09	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Human tox. non-cancer	CTUh	0,00E+00	3,77E-09	8,99E-08	9,36E-08	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
SQP[7)]	-	0,00E+00	1,28E+01	9,83E+01	1,11E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

6) EN 15804+A2 disclaimer for Ionizing radiation, human health. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator; 7) SQP = Land use related impacts/soil quality.

USE OF NATURAL RESOURCES

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renew. PER as energy[8)]	MJ	0,00E+00	3,24E+00	-4,75E+00	-1,51E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Renew. PER as material	MJ	0,00E+00	0,00E+00	8,21E+00	8,21E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Total use of renew. PER	MJ	0,00E+00	3,24E+00	3,46E+00	6,70E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Non-re. PER as energy	MJ	0,00E+00	3,33E+01	8,69E+02	9,03E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Non-re. PER as material	MJ	0,00E+00	0,00E+00	1,09E+01	1,09E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Total use of non-re. PER	MJ	0,00E+00	3,33E+01	8,80E+02	9,13E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Secondary materials	kg	0,00E+00	3,58E-03	7,35E-02	7,71E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Renew. secondary fuels	MJ	0,00E+00	1,49E-05	2,14E-04	2,29E-04	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Non-ren. secondary fuels	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
Use of net fresh water	m^3	0,00E+00	1,10E-02	2,74E-01	2,85E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

8) PER = Primary energy resources.

END OF LIFE – WASTE

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste	kg	0,00E+00	1,85E-02	4,62E-01	4,80E-01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Non-hazardous waste	kg	0,00E+00	3,04E-01	7,16E+02	7,17E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Radioactive waste	kg	0,00E+00	4,67E-04	9,94E-03	1,04E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND

END OF LIFE – OUTPUT FLOWS

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Components for re-use	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Materials for recycling	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Materials for energy rec	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Exported energy	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND

ENVIRONMENTAL IMPACTS – EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global Warming Pot.	kg CO_2e	0,00E+00	3,94E-01	1,14E+01	1,18E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Ozone depletion Pot.	kg CFC_{-11}e	0,00E+00	8,20E-09	1,67E-07	1,76E-07	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Acidification	kg SO_2e	0,00E+00	1,95E-03	5,65E-02	5,84E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
Eutrophication	kg PO_4^3e	0,00E+00	5,14E-04	4,24E-02	4,29E-02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
POCP (“smog”)	kg C_2H_4e	0,00E+00	1,48E-04	3,84E-03	3,99E-03	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
ADP-elements	kg Sbe	3,67E-05	1,02E-06	3,59E-05	7,36E-05	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND
ADP-fossil	MJ	0,00E+00	4,47E+00	6,23E+02	6,27E+02	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND

ENVIRONMENTAL IMPACTS – GWP-GHG - THE INTERNATIONAL EPD SYSTEM

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-GHG[9)]	kg CO_2e	0,00E+00	3,96E-01	1,14E+01	1,18E+01	MND	MND	MND	MND	MND	MND	MND	MND	MND	MNR	MND	MND	MND	MND

9) This indicator includes all greenhouse gases excluding biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013). In addition, the characterisation factors for the flows - CH4 fossil, CH4 biogenic and Dinitrogen monoxide - were updated in line with the guidance of IES PCR 1.2.5 Annex 1. This indicator is identical to the GWP-total of EN 15804:2012+A2:2019 except that the characterization factor for biogenic CO2 is set to zero.

VERIFICATION STATEMENT

VERIFICATION PROCESS FOR THIS EPD

This EPD has been verified in accordance with ISO 14025 by an independent, third-party verifier by reviewing results, documents and compliancy with reference standard, ISO 14025 and ISO 14040/14044, following the process and checklists of the program operator for:

- This Environmental Product Declaration
- The Life-Cycle Assessment used in this EPD
- The digital background data for this EPD

Why does verification transparency matter? Read more online
This EPD has been generated by One Click LCA EPD generator, which has been verified and approved by the EPD Hub.

THIRD-PARTY VERIFICATION STATEMENT

I hereby confirm that, following detailed examination, I have not established any relevant deviations by the studied Environmental Product Declaration (EPD), its LCA and project report, in terms of the data collected and used in the LCA calculations, the way the LCA-based calculations have been carried out, the presentation of environmental data in the EPD, and other additional environmental information, as present with respect to the procedural and methodological requirements in ISO 14025:2010 and reference standard.

I confirm that the company-specific data has been examined as regards plausibility and consistency; the declaration owner is responsible for its factual integrity and legal compliance.

I confirm that I have sufficient knowledge and experience of construction products, this specific product category, the construction industry, relevant standards, and the geographical area of the EPD to carry out this verification.

I confirm my independence in my role as verifier; I have not been involved in the execution of the LCA or in the development of the declaration and have no conflicts of interest regarding this verification.

HaiHa Nguyen, as an authorized verifier acting for EPD Hub Limited
23.01.2025

VERIFIED ISO 14025